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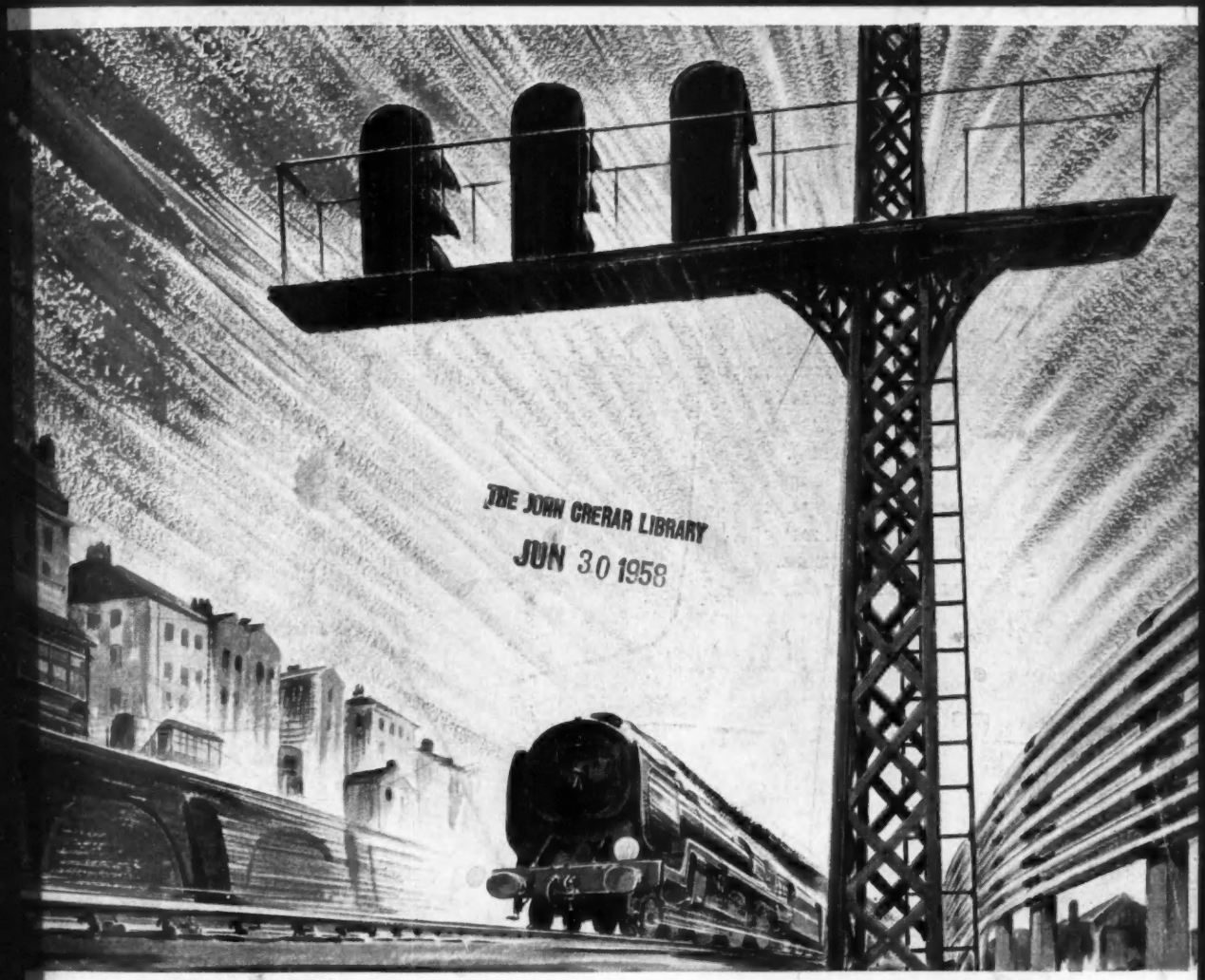

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You can standardise on motor starters with MEM 'Autoline'

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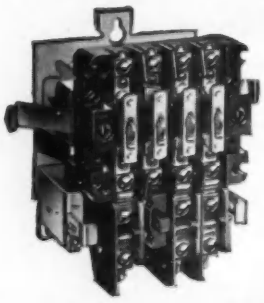
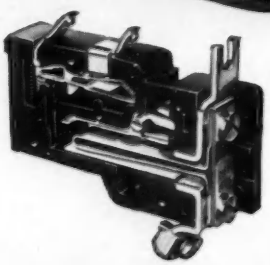
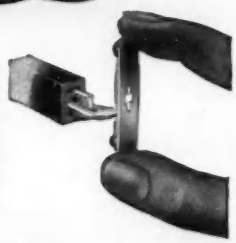


The Skeleton Pattern Units can be combined in various ways to meet a wide variety of different needs on machine tool applications.

Any MEM "AUTOLINE" starter can be changed from Automatic to Manual resetting operation in a few moments. A cover with "Reset" button only is available.



Exclusive new overload relay design with heaters specially designed for each rating means accurate protection under all conditions.



Contacts are of solid silver. Contact replacement is especially simple. Just flick over a spring catch and lift off.

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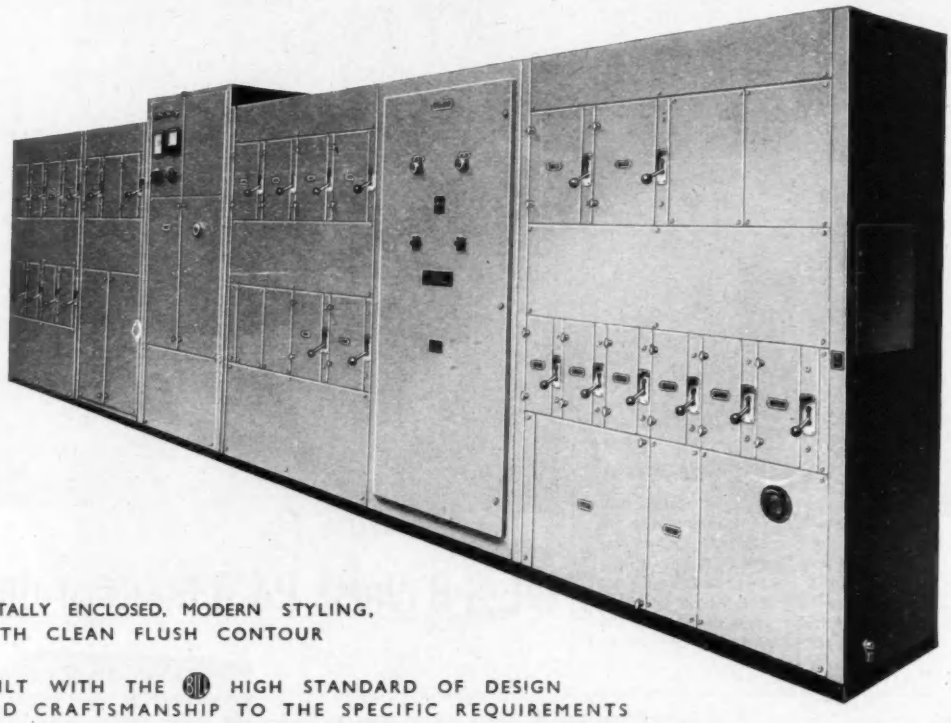

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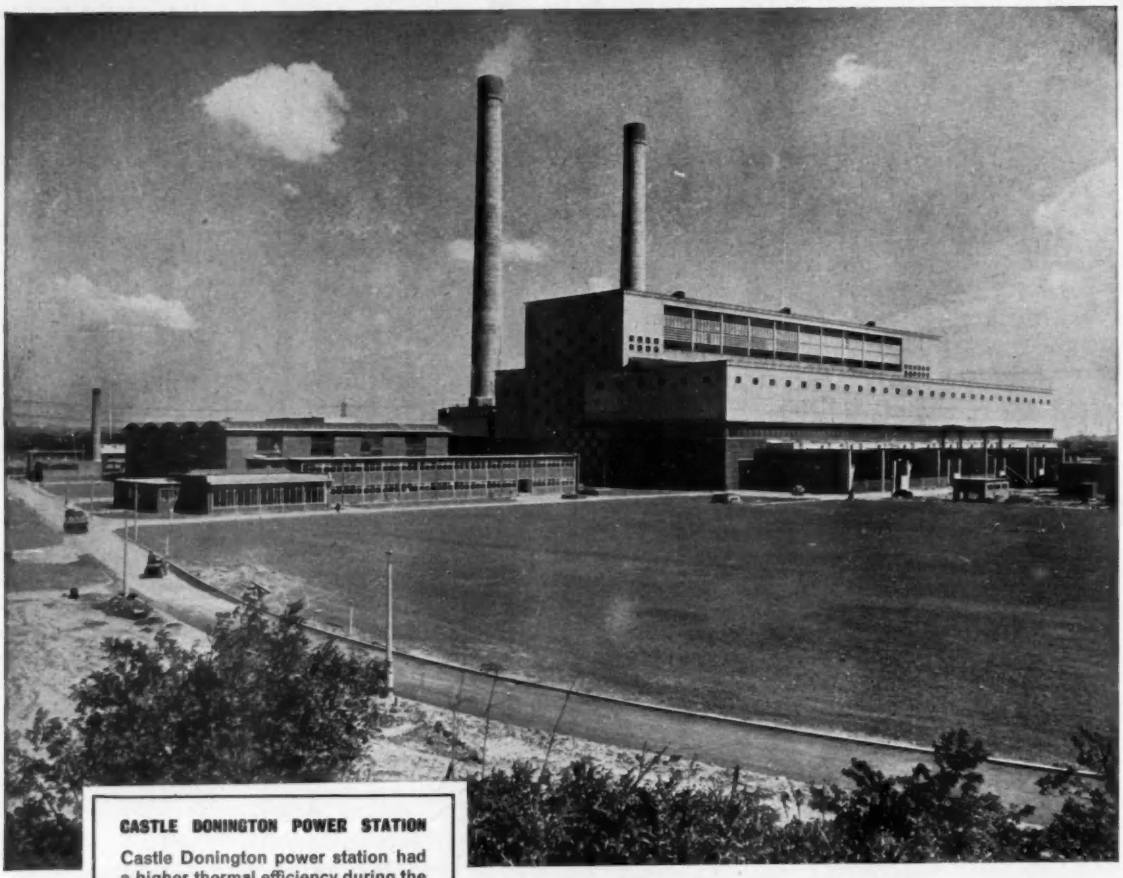

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Castle Donington power station had a higher thermal efficiency during the year ended 31st Mar., 1957, than any other power station in Great Britain. The motors driving the auxiliaries are protected by P & B Golds relays in this and many other power stations of the Central Electricity Generating Board.

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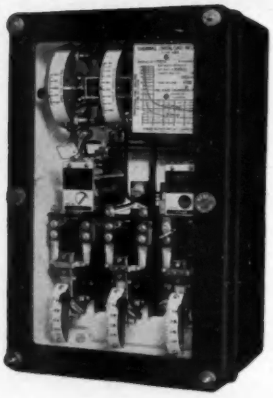

P & B Relays give full protection for motors with any starting periods or currents under extremes of ambient temperature.
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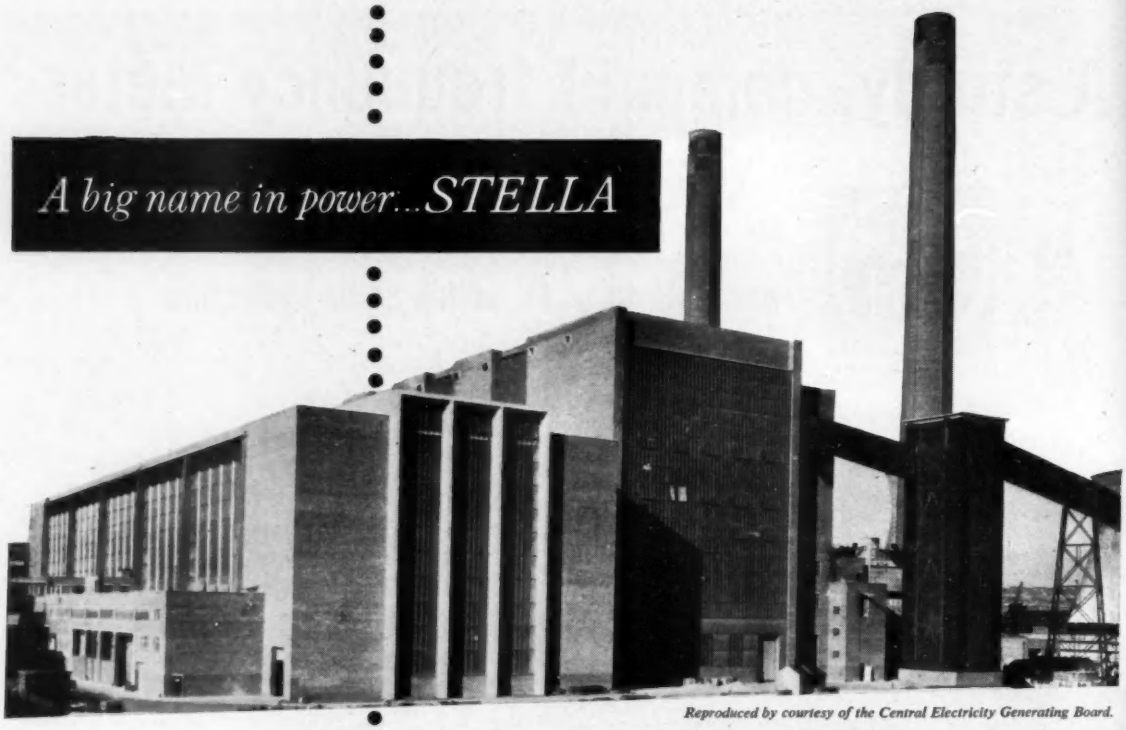

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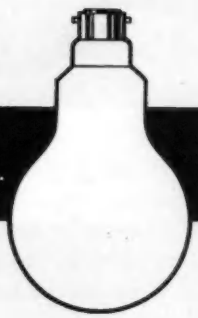

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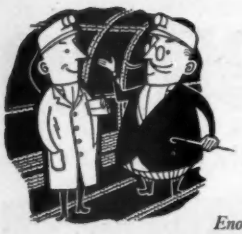

But if it's Buxton certified, isn't that enough?

Enough from the safety point of view, yes sir. These Brush Flameproof motors are Buxton certified for Groups 1 and 2 atmospheres. But they are much more besides.

You mean this non-breathing business?

Yes sir. You see, in atmospheres laden with small dust particles, a motor of the conventional flameproof type will inhale dust as it 'breathes'—that is, as the air enclosed by the casing expands and contracts. In a damp and dirty atmosphere a tremendous amount of dirt and moisture is drawn into the machine after 'shut down'. Well, the Brush Non-breathing Type is so designed that the free air space within the casing is reduced to an absolute minimum. So the breathing volume is cut down to the smallest possible level.

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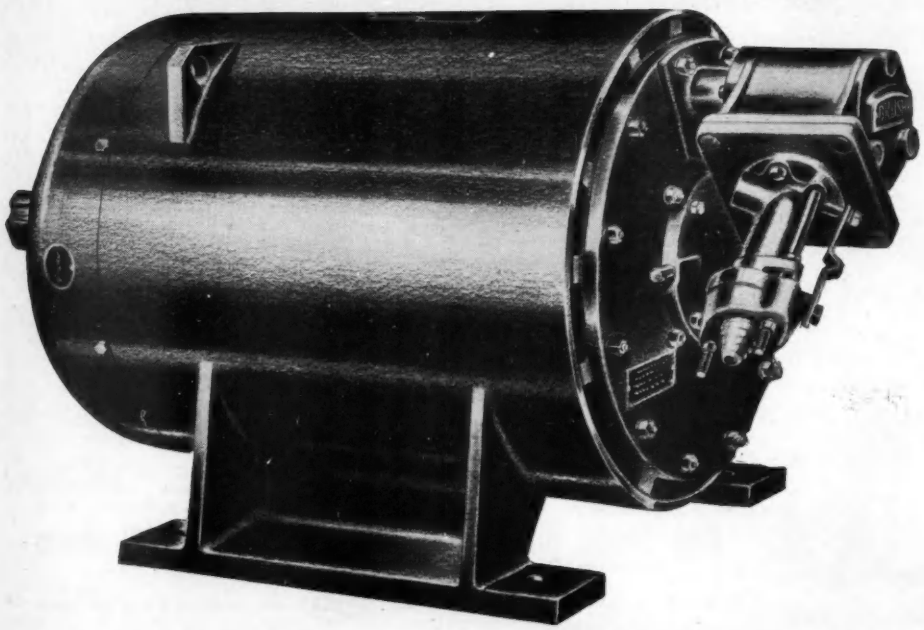

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Powerful Burco heater boils quickly, thoroughly. 3-heat control keeps water fast boiling, slow boiling or simmering. Up-to-the-minute styling, with luxurious enamel finish. Movable, mounted on castors. White with two tones of blue or cream with two tones of blue. Model E300

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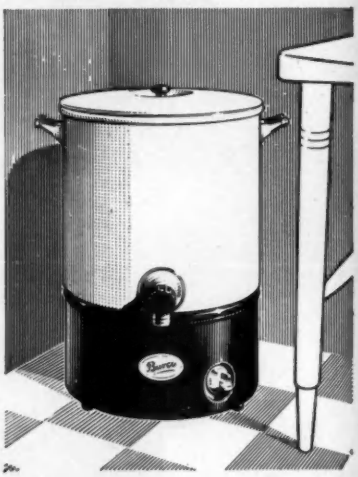

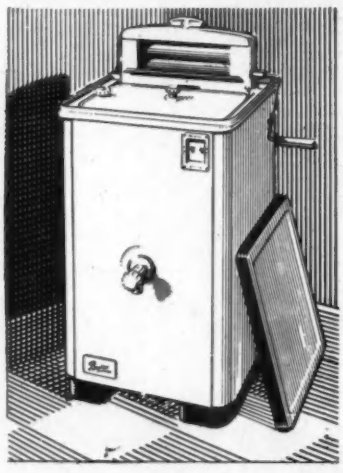

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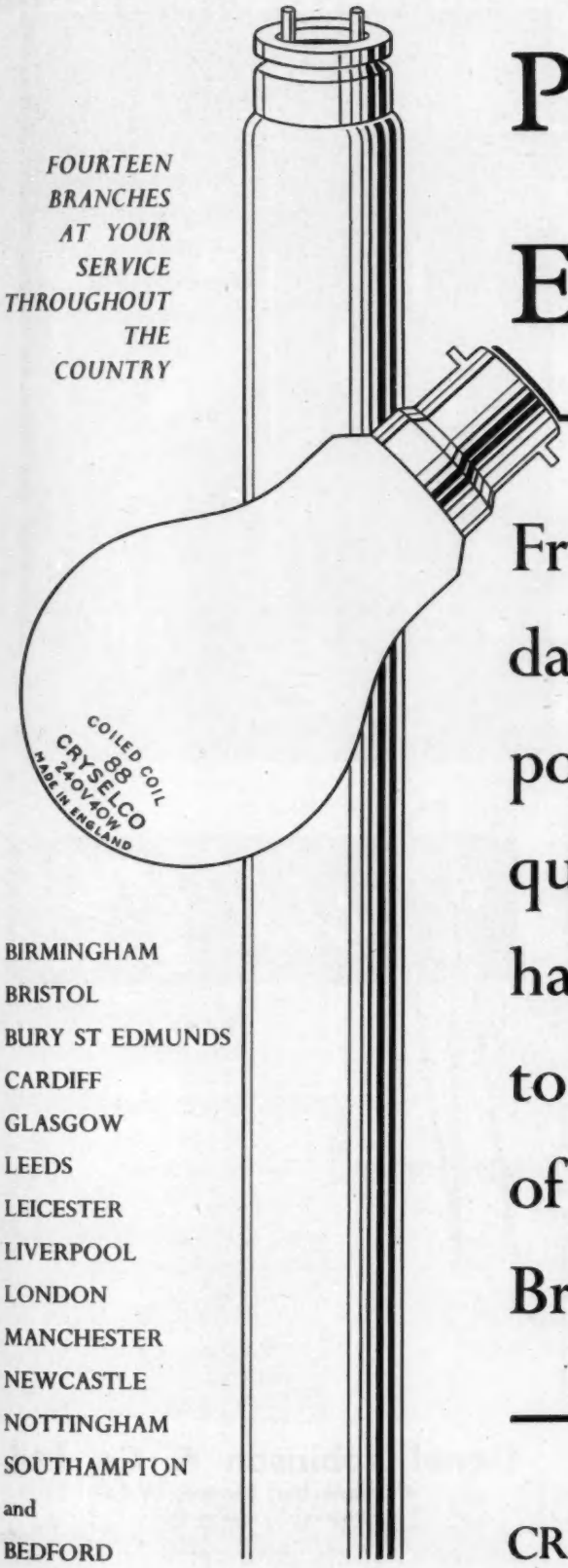

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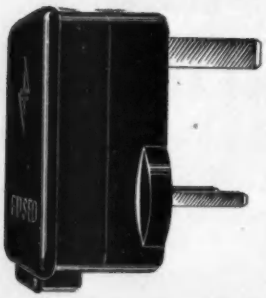

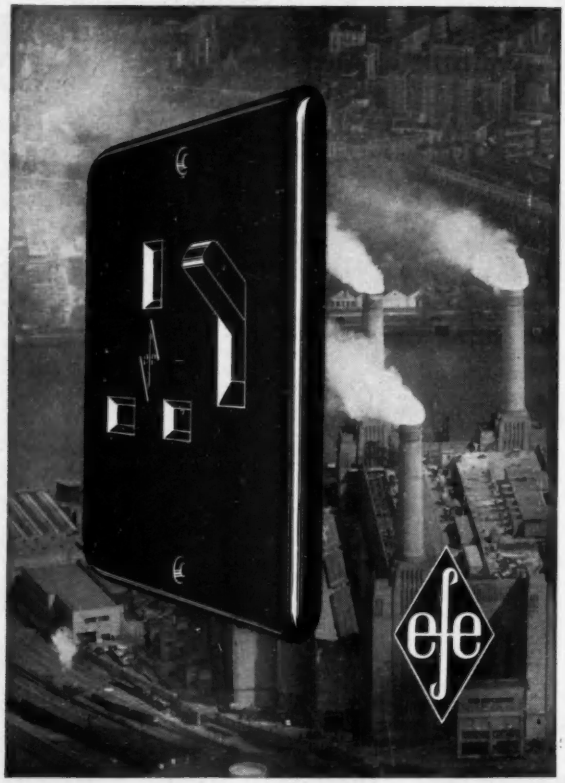

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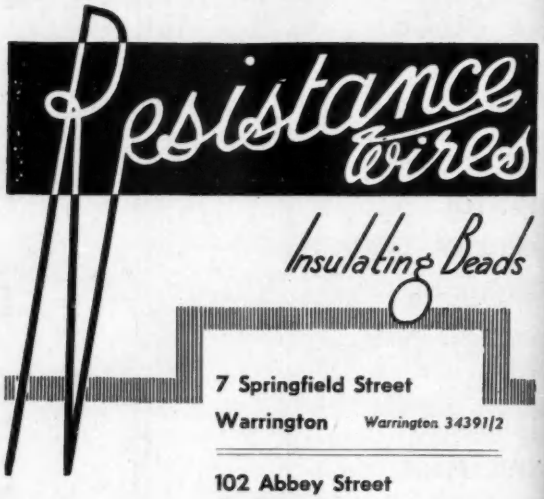

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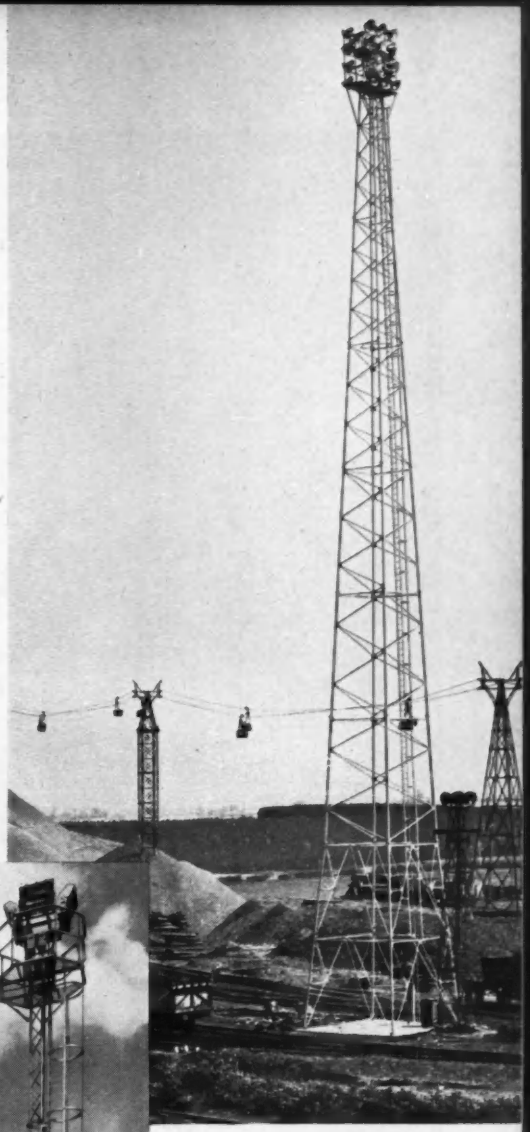

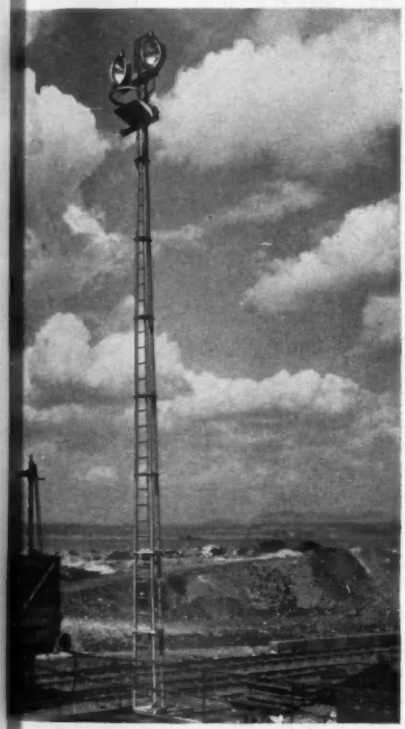

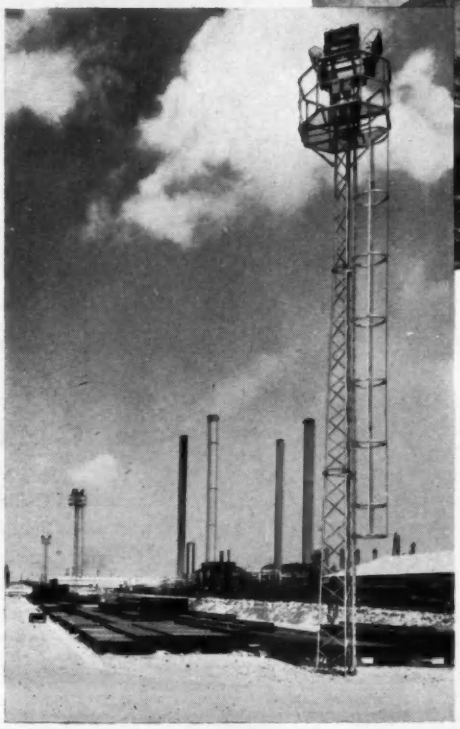

Above: Standard 150/75 Type Tower, 150 ft. high, supplied to the National Coal Board, Blidworth Colliery, Mansfield, Notts. A type 'C' rectangular platform is fitted.

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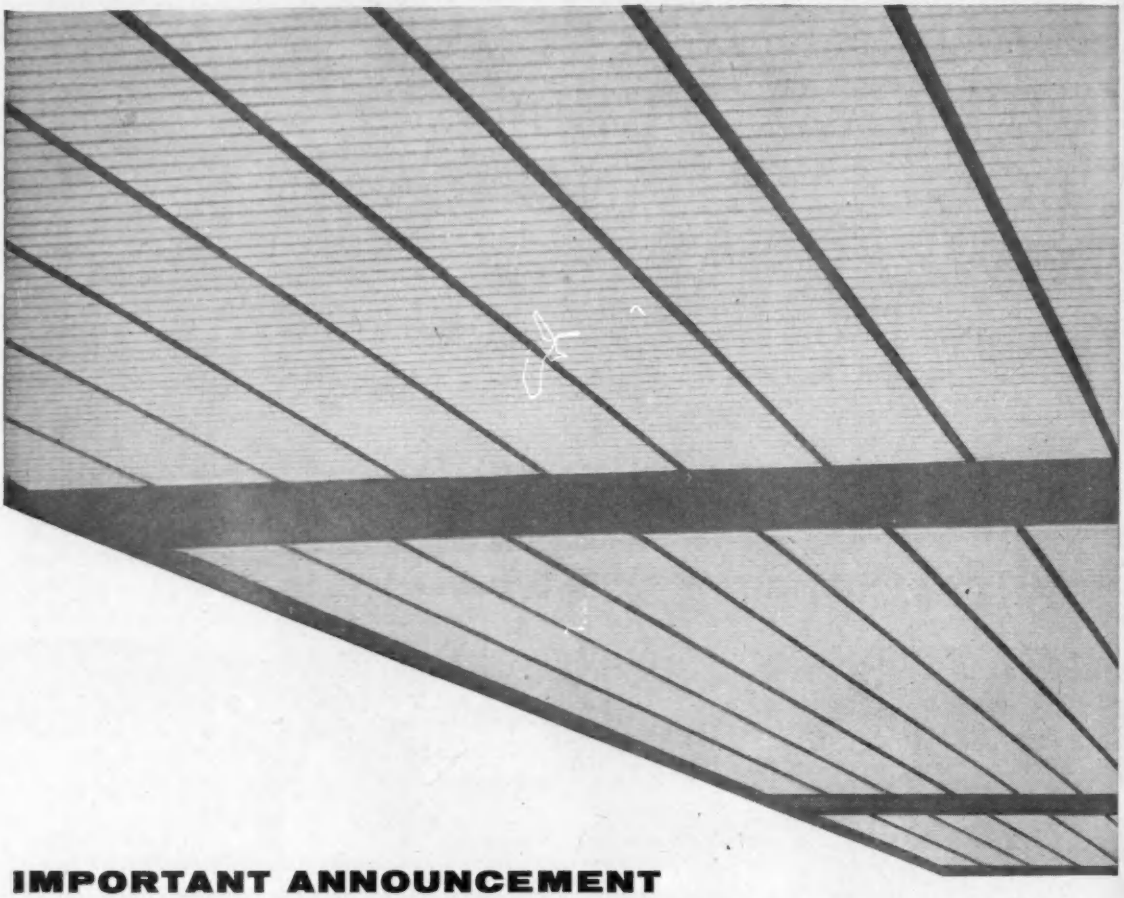

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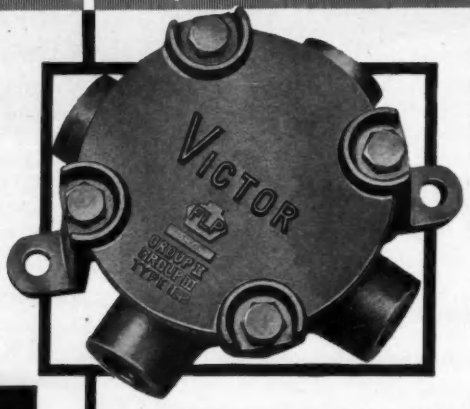

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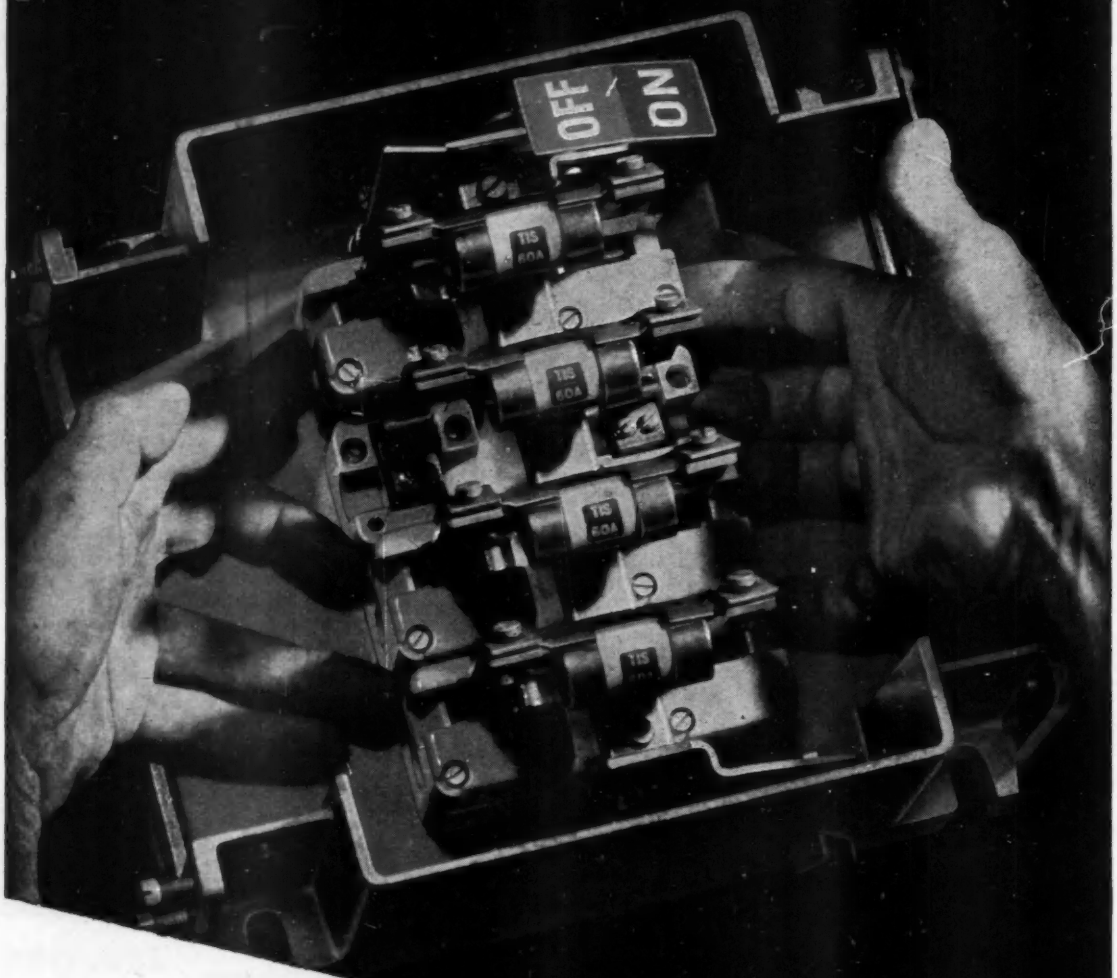

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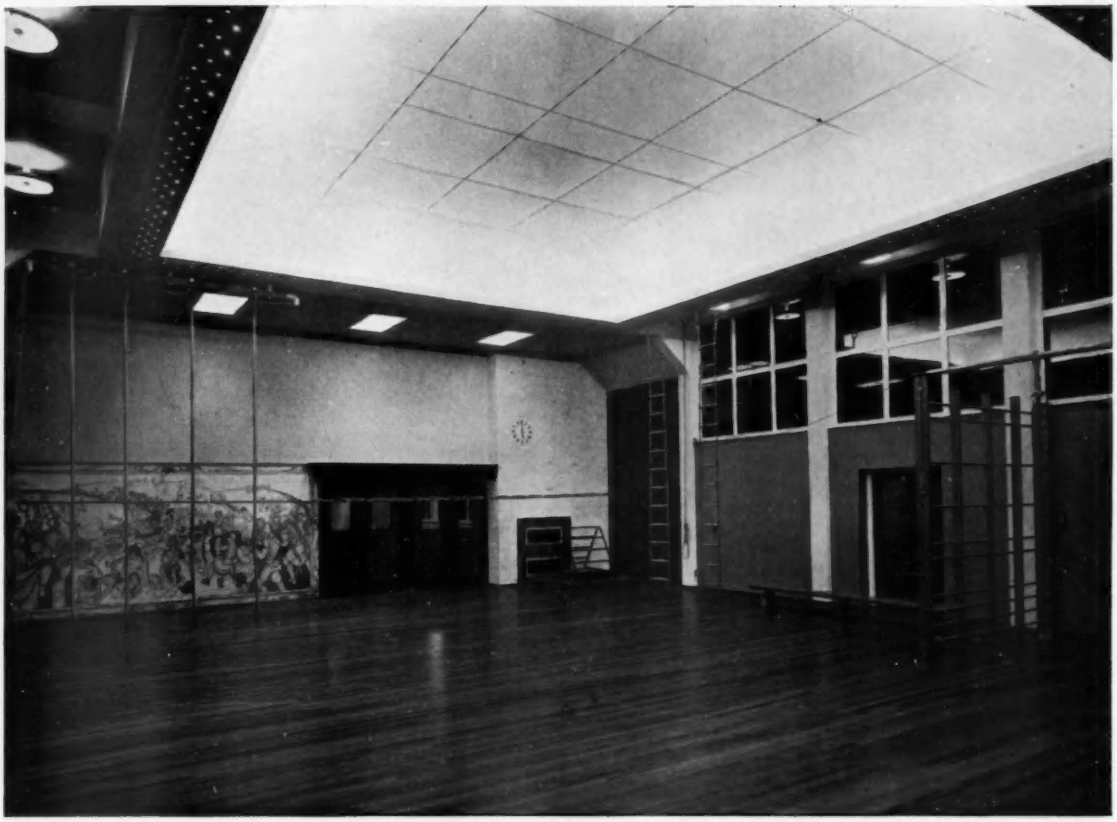

Dorchester Primary School

helps to build for the future

The Philips Lighting Design Service offers comprehensive expert advice from a team of experienced lighting engineers and a qualified architect who has made a special study of light in relation to colour — all this, *without charge or obligation.* The service has, since its inception, been responsible for many of the most imaginative lighting schemes devised in recent years. You can avail yourself of it simply by asking your electrical contractor or getting in touch with Philips direct.

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THOUSANDS OF L.S.E. MOTORS, both N-S variable-speed and induction types, drive auxiliaries in modern power stations

'Trislot' high-torque squirrel-cage motors driving circulating water pumps, Ferrybridge 'B' power station. Weather-proof type with water coolers, 900 h.p., 490 r.p.m.

LAURENCE, SCOTT & ELECTROMOTORS LTD.

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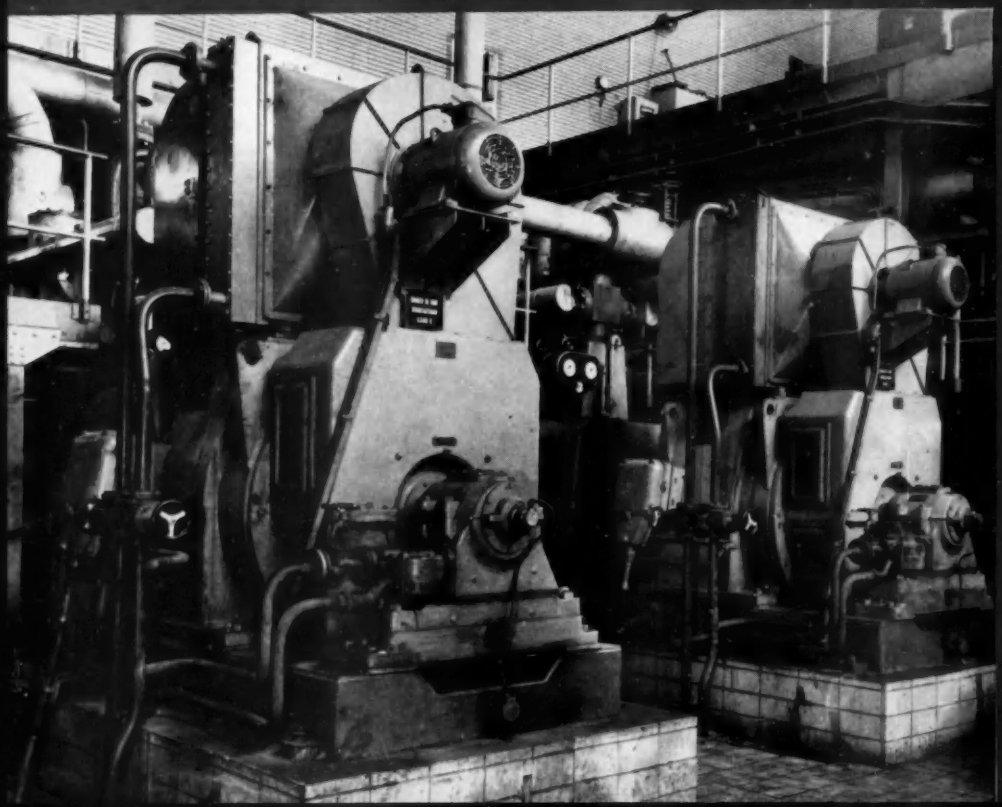

N-S variable-speed a.c. motor driving boiler feed pumps at Alost power station (Belgium). Closed air-circuit type with water coolers, 635/237 h.p., 1070/400 r.p.m.

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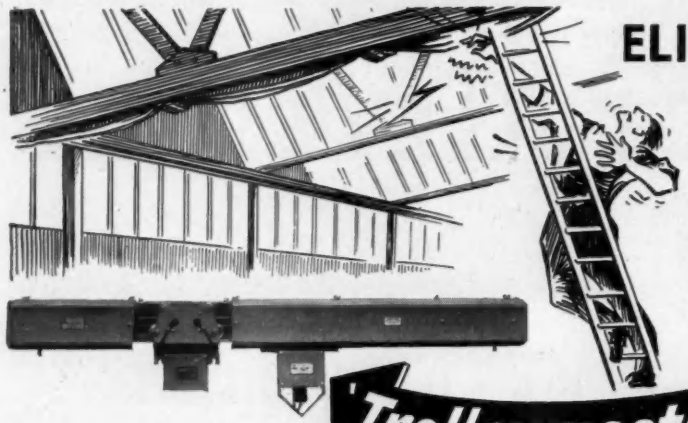

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Eliminate the risk of accidents by having your Electrical Power supplies totally enclosed in an accident proof casing and still have all the advantages of a power supply when and where you need it. The E.M.S. "TROLLEYMASTER" Enclosed Collector Track is a fool-proof system of moveable power distribution and is designed to reduce the danger from trailing flexible leads and exposed conductors.

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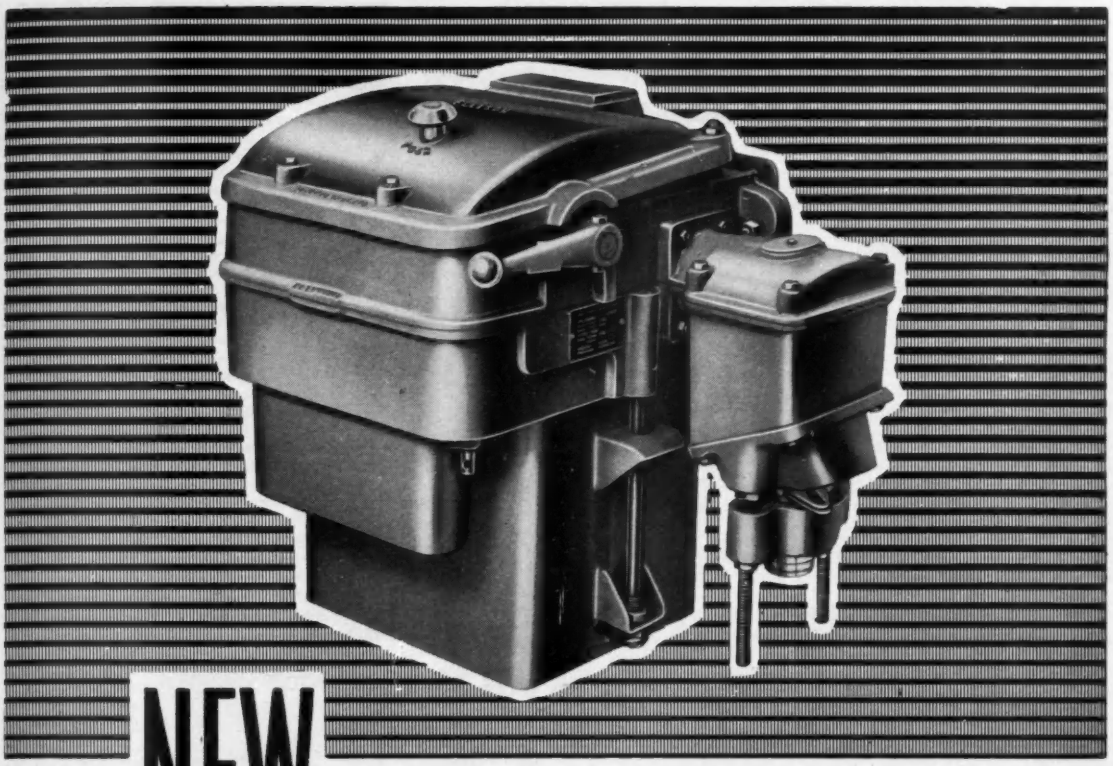

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BREAKING CAPACITY 25 MVA at 400 VOLTS

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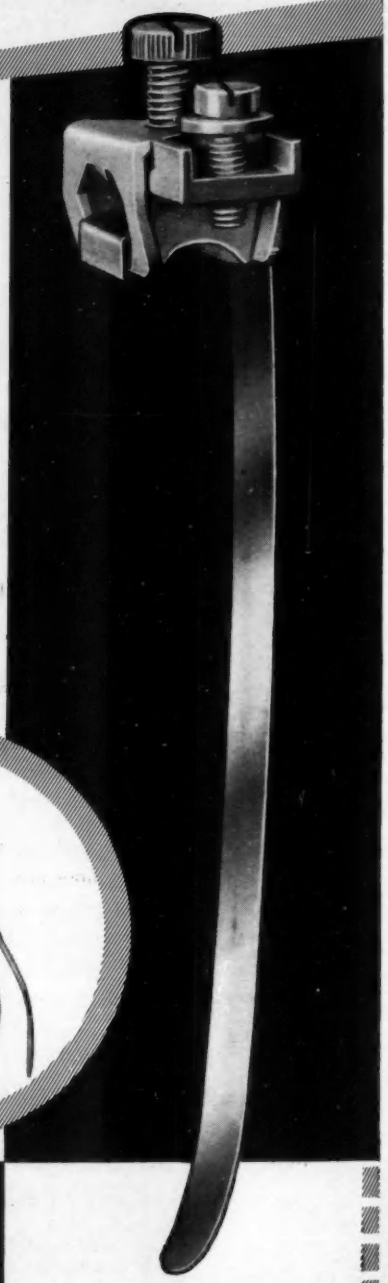

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smaller
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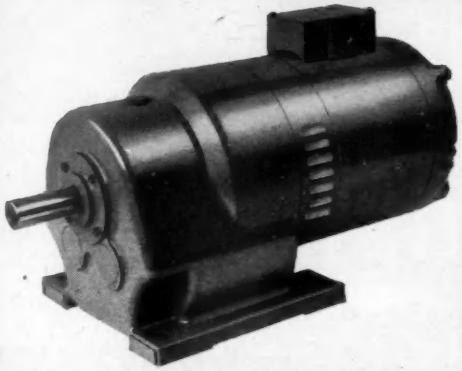

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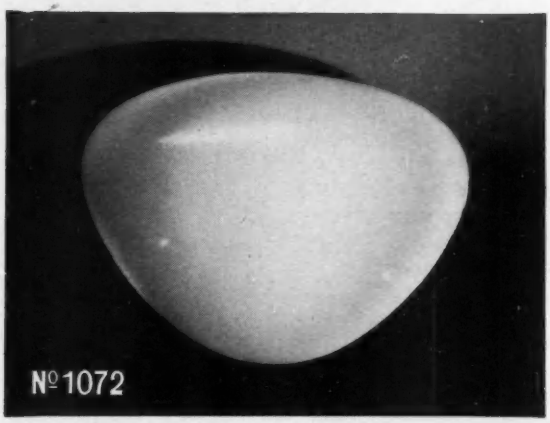

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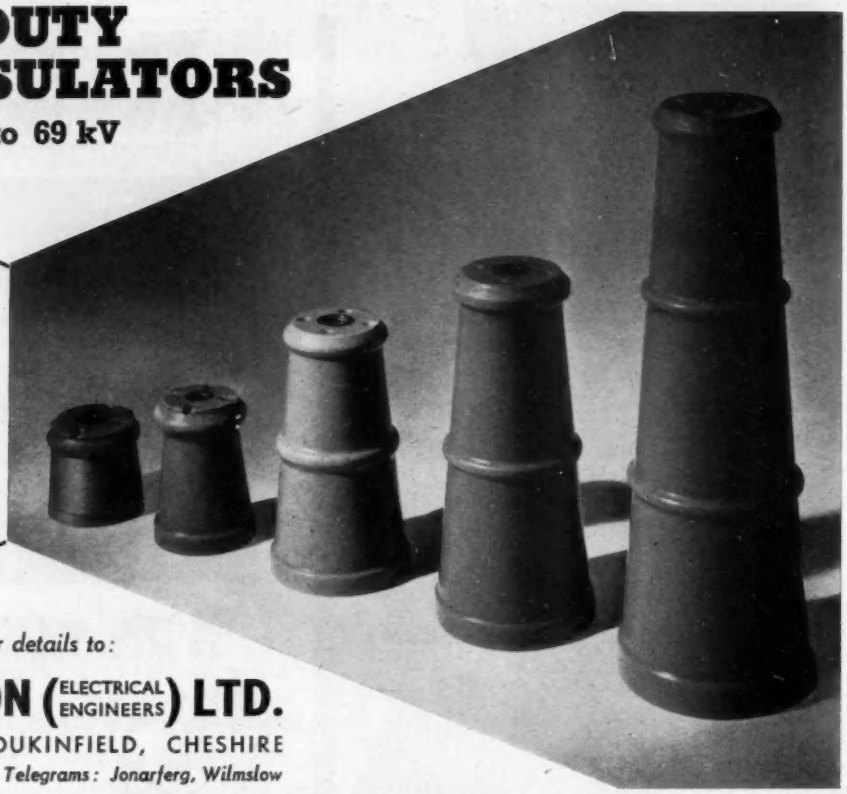

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TUNGSTONE BATTERIES have been designed to meet Post Office and British Standard Specifications. They are being used in Power Stations and Telephone Exchanges all over the British Isles, Australia, India, New Zealand, South Africa, West Indies, Portugal, Venezuela, etc.

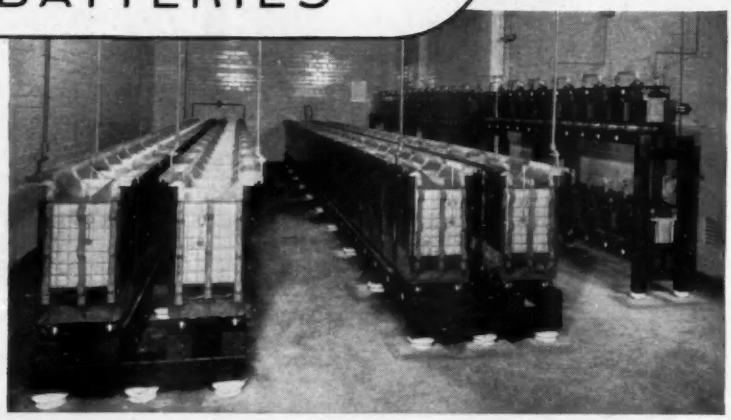

Illustration shows the installation of a 240 VOLT TUNGSTONE BATTERY *500 a.h. capacity Open Type BSSD. 11, and two Batteries of Tungstone enclosed type cells, one of 100 a.h. capacity type 25G9S and the other of 75 a.h. capacity type 25G7S.*

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Works: MARKET HARBOROUGH, LEICS.

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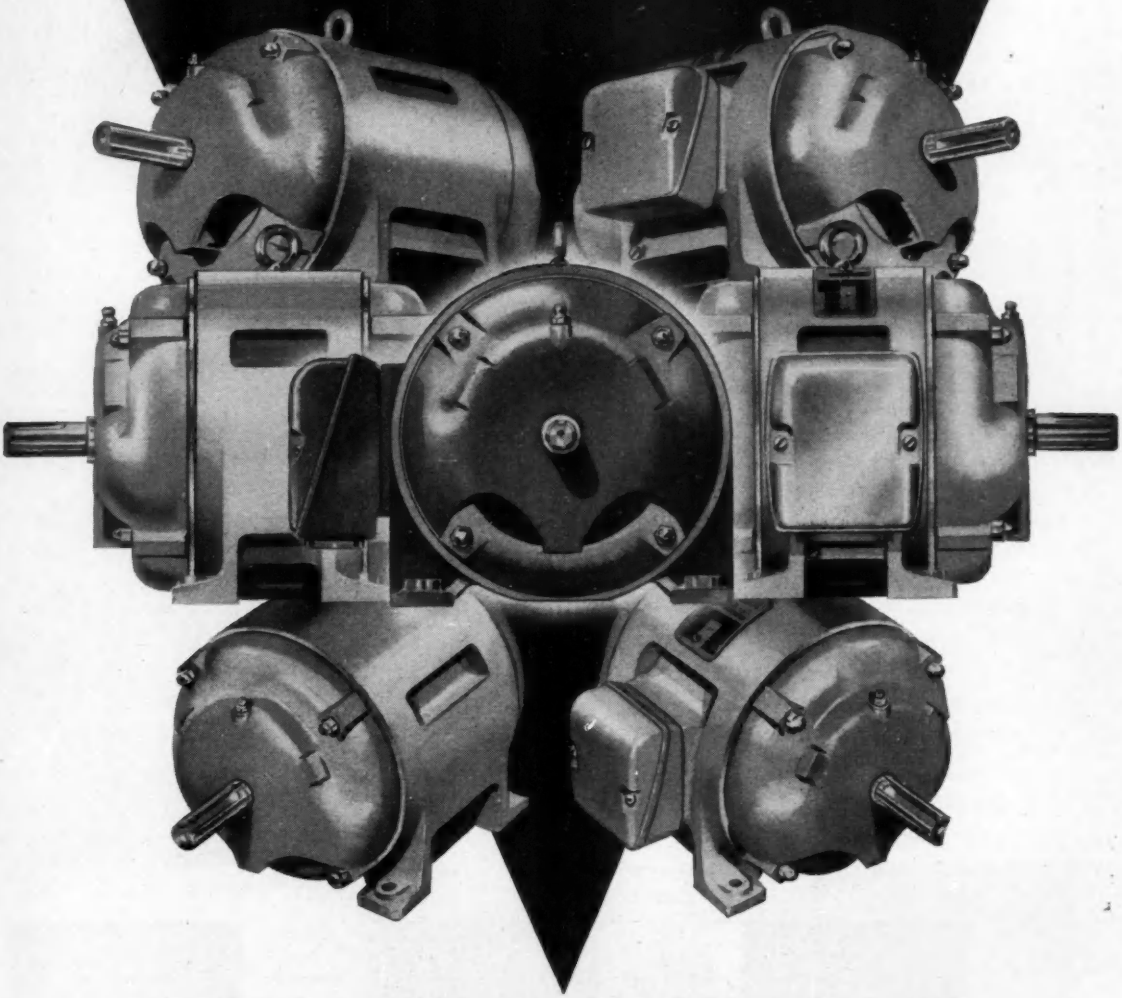
FROM EVERY ANGLE



The BROOK 'C' type motor represents the finest value in the world. This new design embodies the results of fifty years progress and research. It complies with British Standard 2960 : 1958.

Smaller size—lighter weight—better ventilation—new terminal board and cover—high output—moderate temperature rise — inexpensive.

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BROOK MOTOR CORPORATION

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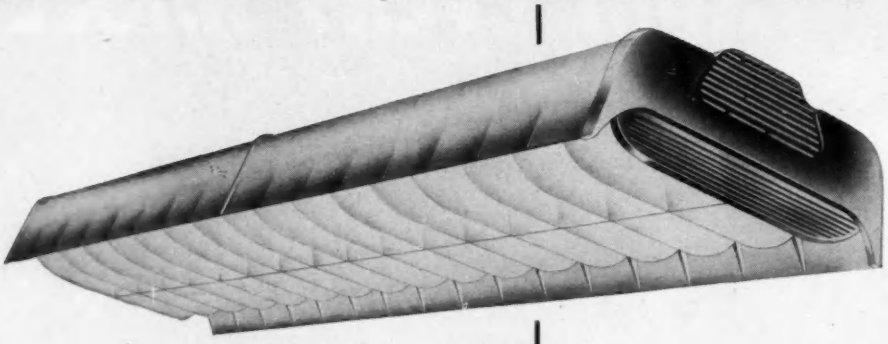


Luveline IS EFFICIENT — Luveline is 88.4% efficient.

GLAREFREE — The light is completely diffused giving a soft, restful and almost shadowless illumination.

EASILY INSTALLED — There are only three basic components.

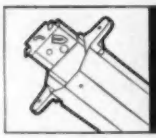
EASILY CLEANED — The simple hingeing device makes relamping and cleaning a matter of minutes.

VERSATILE — It can be used as individual fittings or in continuous lines.

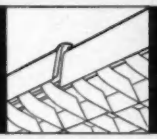
PERFECTLY ALIGNED — Unsightly "dog legs" in continuous lines of fittings are a thing of the past.

EVENLY LUMINOUS — The special lapping of diffuser elements gives a continuous luminous surface throughout its length, even where lamps are butted end to end.

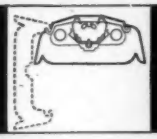
*ITS SUCCESS IN CANADA AND THE USA GUARANTEES IT FOR GREAT BRITAIN * ONLY* **Luveline** *HAS THESE EXCLUSIVE "WILSON" FEATURES:*



ALIGNMENT
Special mounting brackets give positive alignment of channels and simplify installation.



LAP-JOINT
Good design and accurate moulding give a "no light-leak" join for continuous row mounting.



MAINTENANCE
A simple hingeing device allows the one-piece shielding to swing down or to be removed altogether for cleaning.

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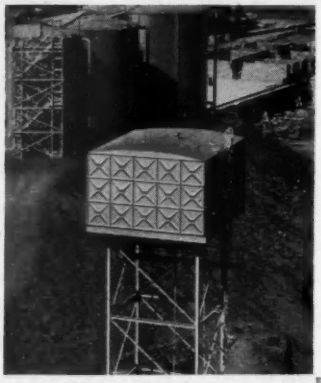

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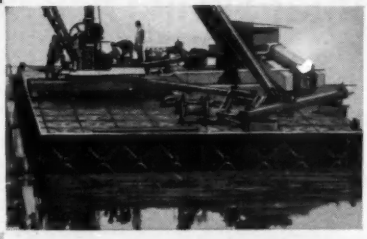
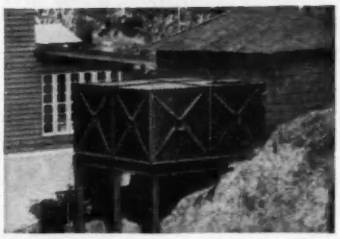
The unit method of construction enables Braithwaite Pressed Steel Tanks to be supplied in an unlimited range of capacities and to be conveyed to and erected in positions unsuitable for other forms of construction. In addition to providing adequate liquid reserves for many industrial needs, Braithwaite Tanks are playing an increasing part in bringing essential services and improving the standards of living to established communities and are a means of providing many of the basic amenities where backward areas are being opened up and developed.



A pontoon for civil engineering work made from units built with pressed steel tank plates



Storage for 1,400 gallons at a tea garden, Ceylon

Storage for 65,100 gallons for a rural community, Belgian Congo

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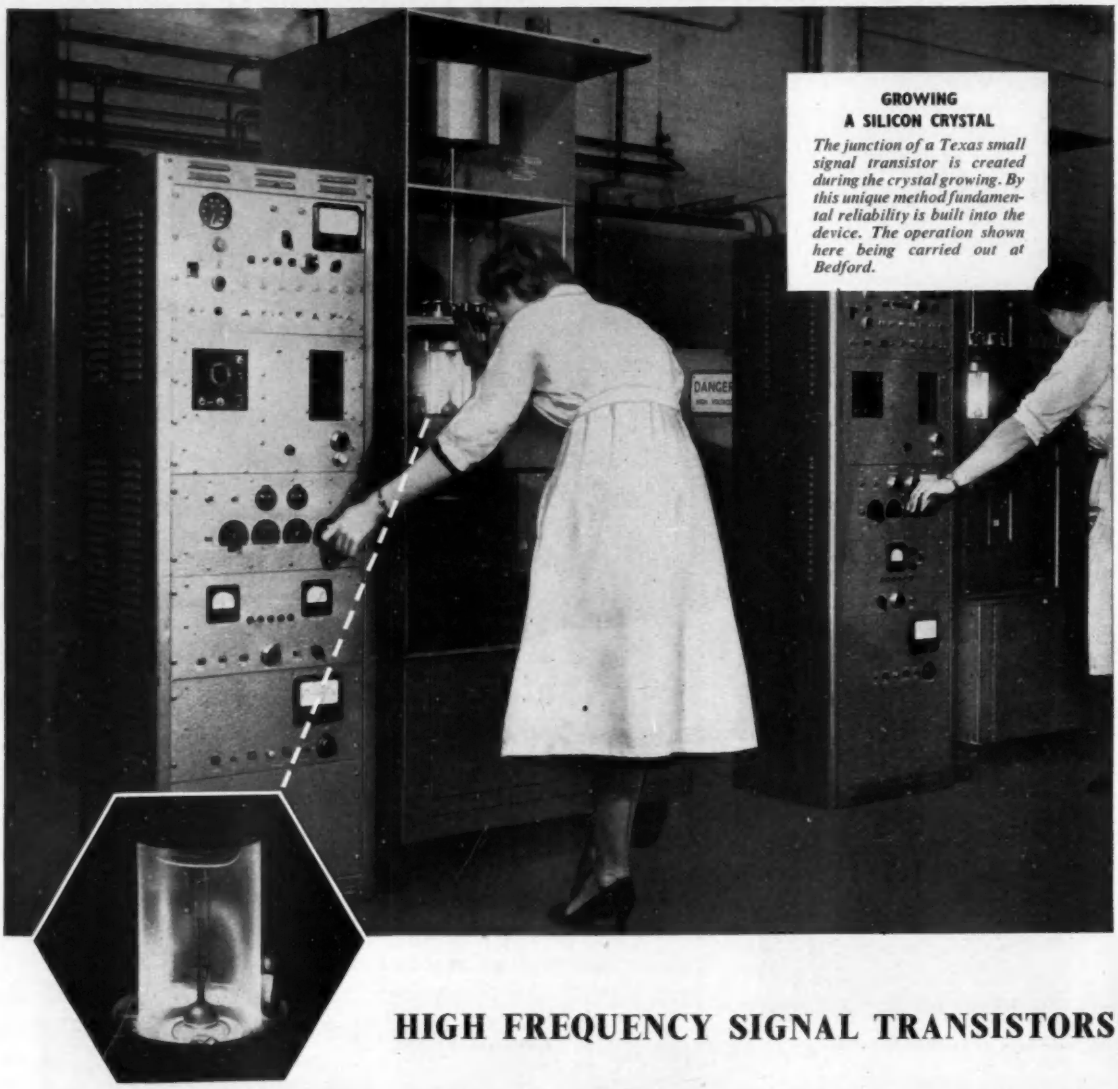

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Max. Collector Current = 25 mA
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2S002	20-40	4
2S003	20-40	10
2S004	36-90	4
2S005	45-150	20

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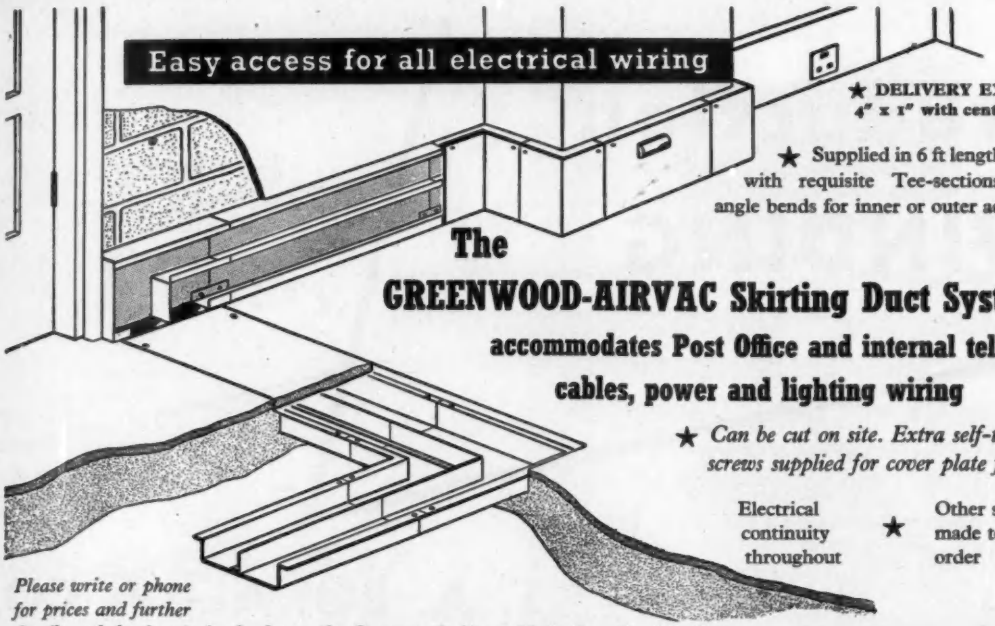

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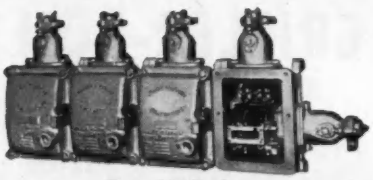
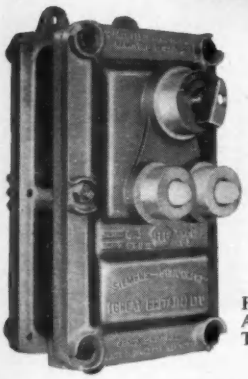
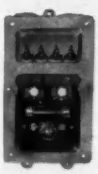


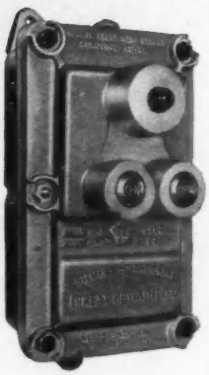
Type FS 15 amp Triple Pole Distribution Board with Core Balance Earth Leakage Protection



Flame Proof Annunciator Type P.3



Flame Proof Push-Button Type P.2



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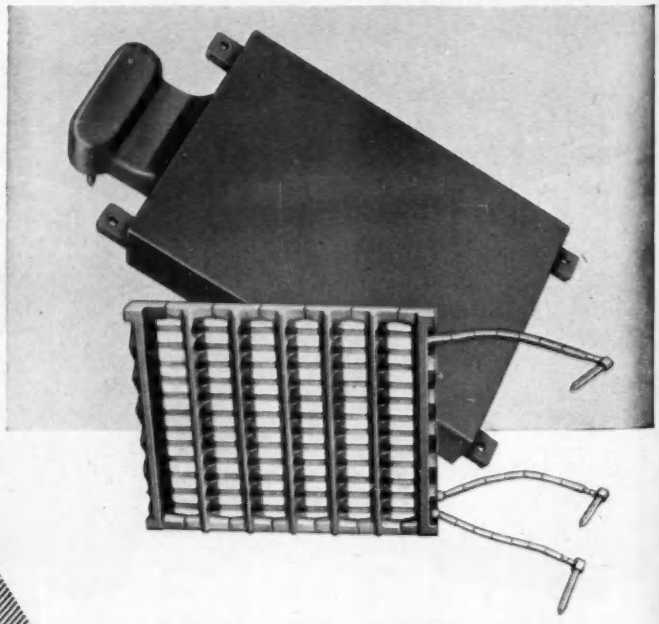

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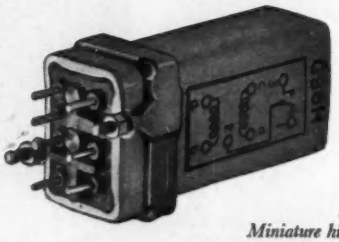
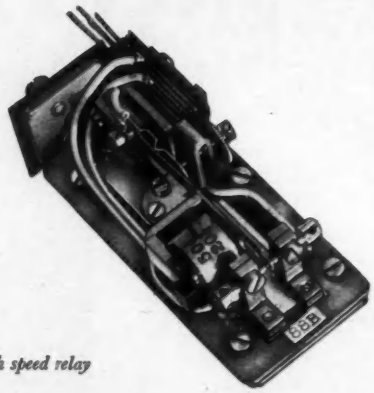


Miniature high speed sealed relay



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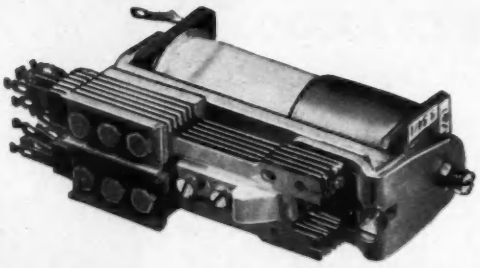

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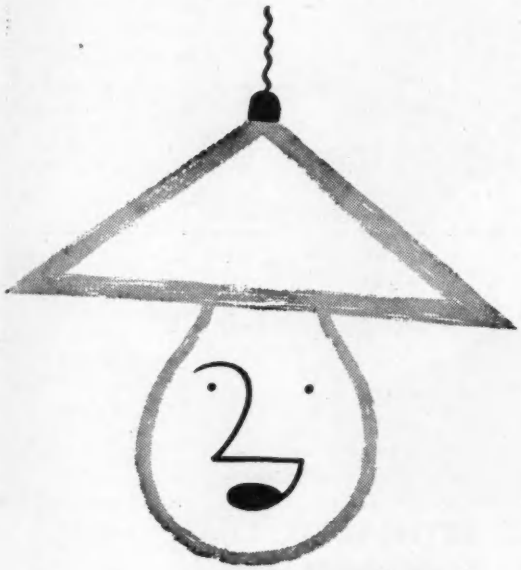

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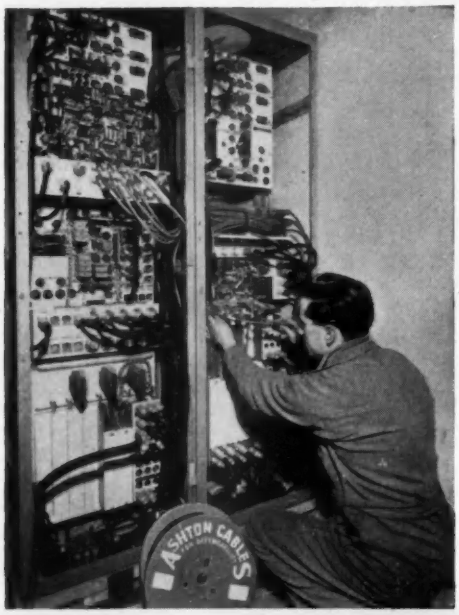

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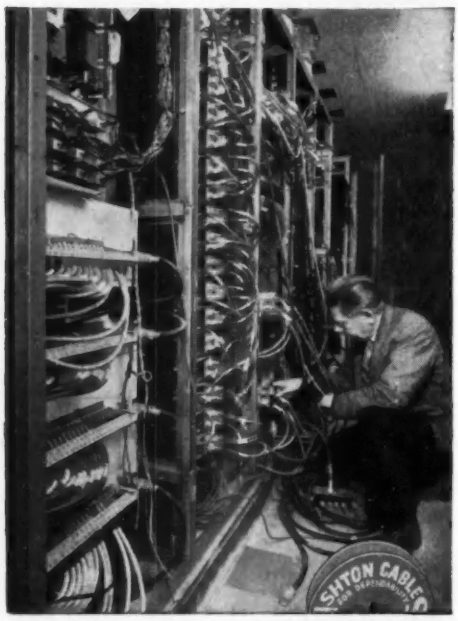

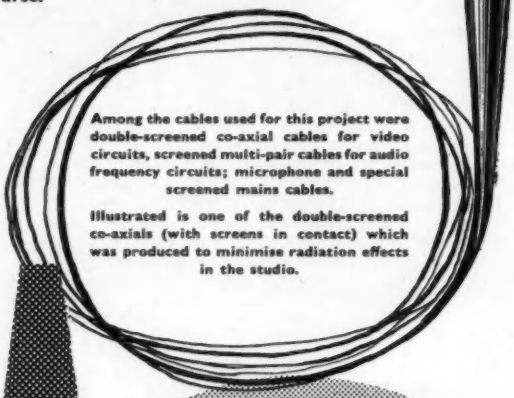

Among the cables used for this project were double-screened co-axial cables for video circuits, screened multi-pair cables for audio frequency circuits; microphone and special screened mains cables.

Illustrated is one of the double-screened co-axials (with screens in contact) which was produced to minimise radiation effects in the studio.

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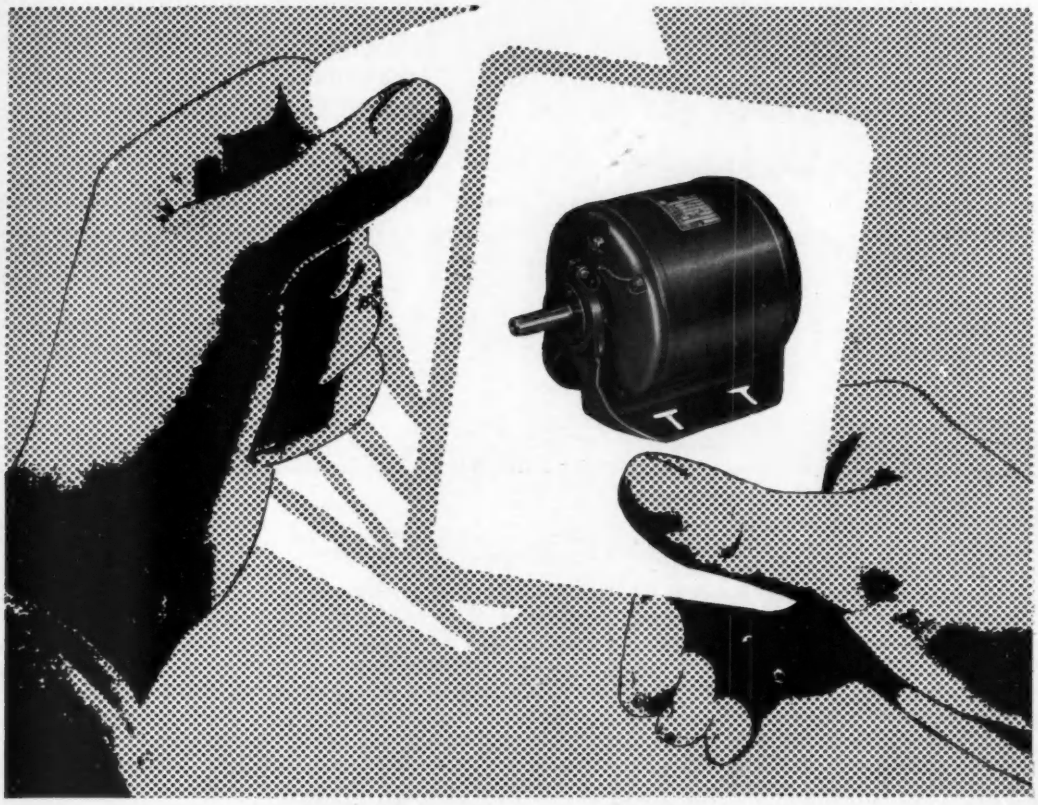

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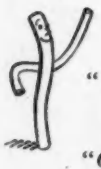
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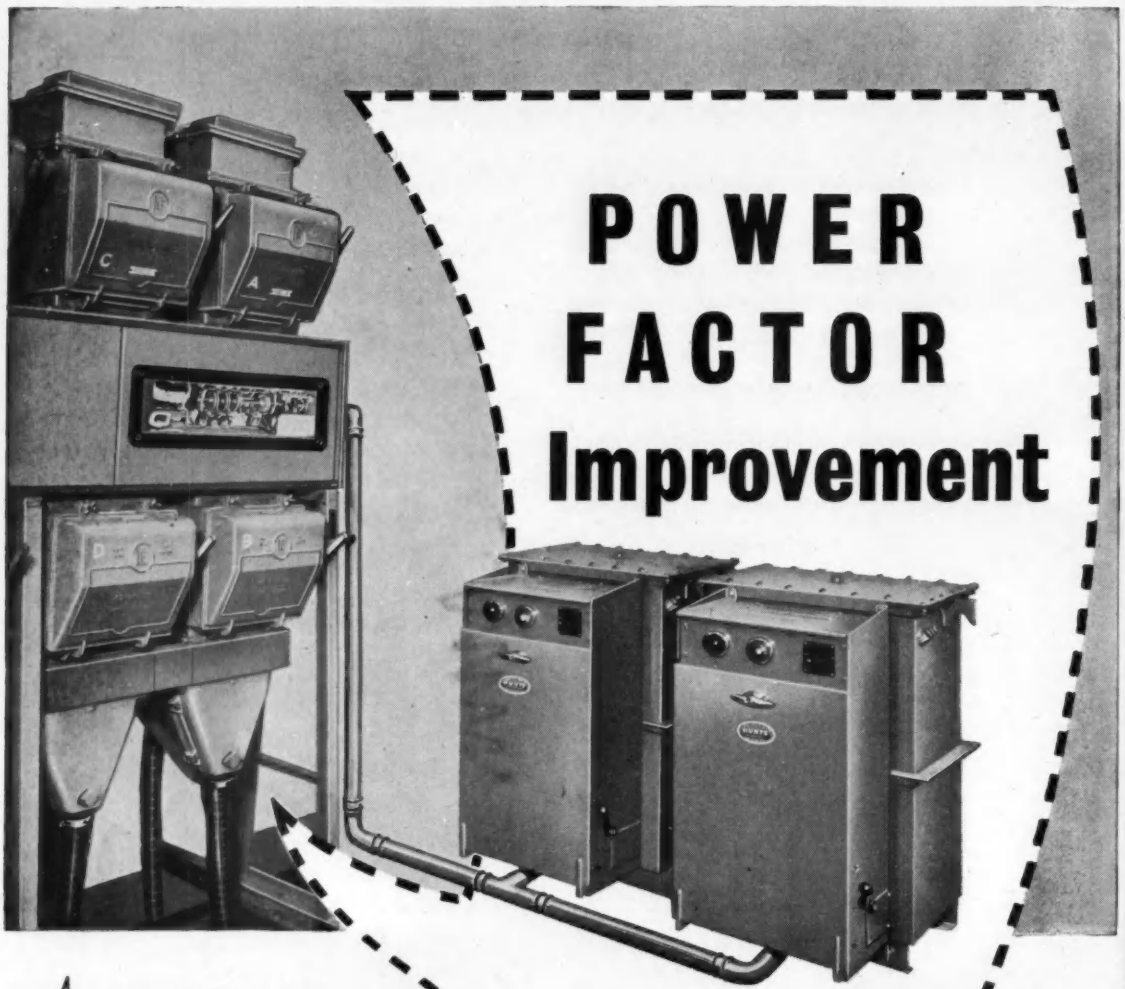

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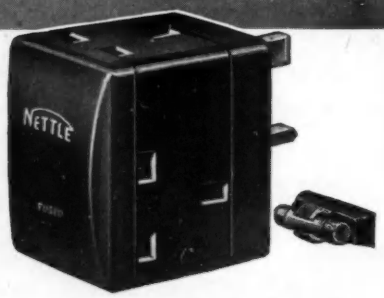

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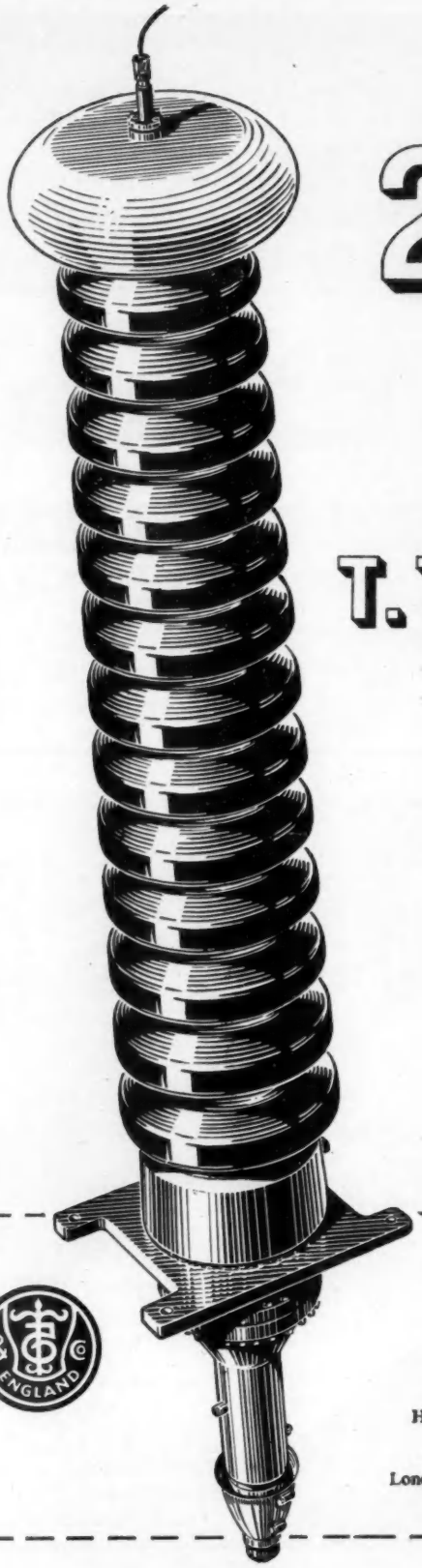

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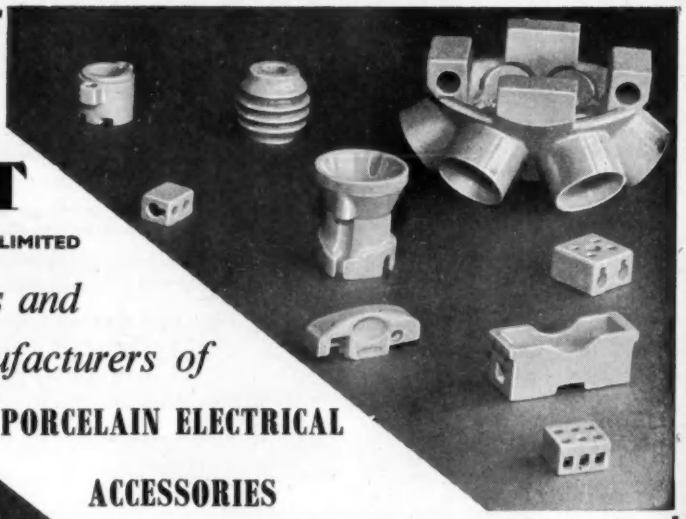

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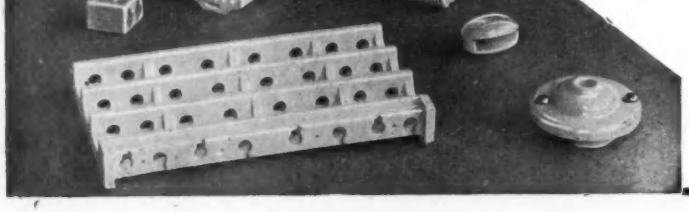

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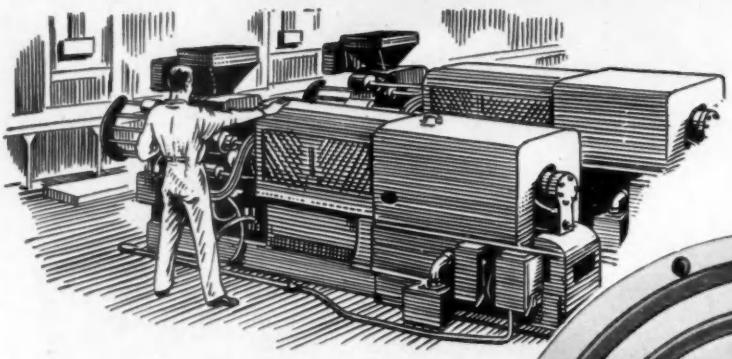

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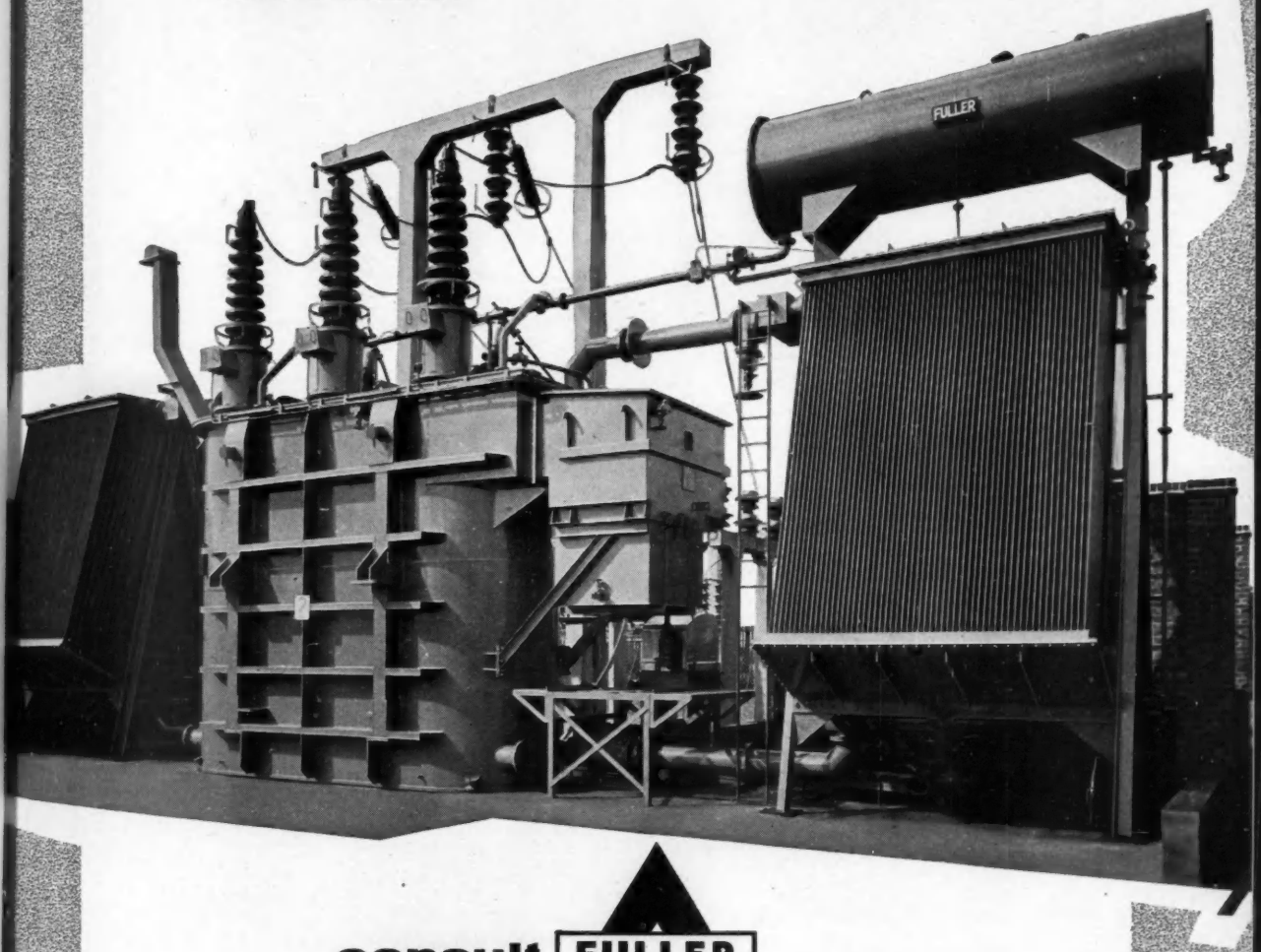

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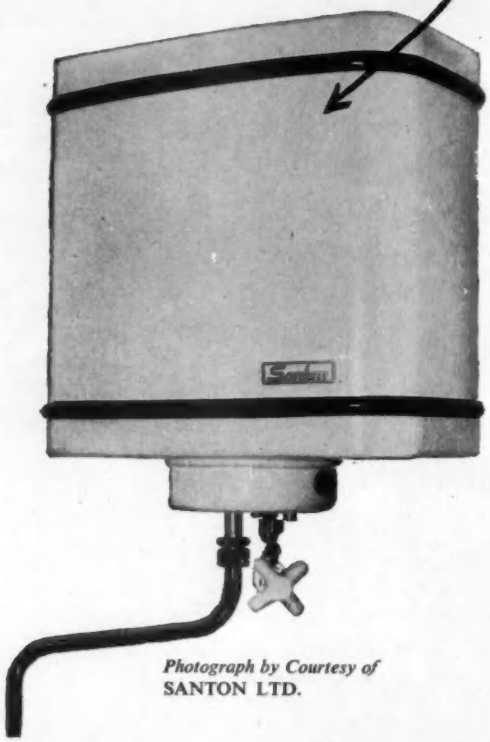

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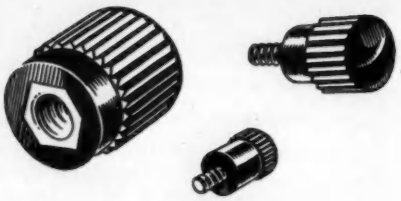

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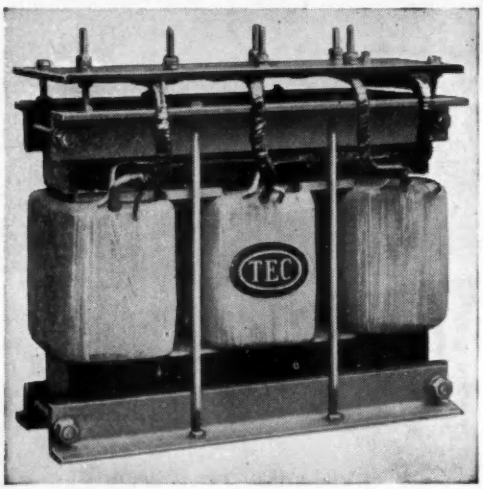

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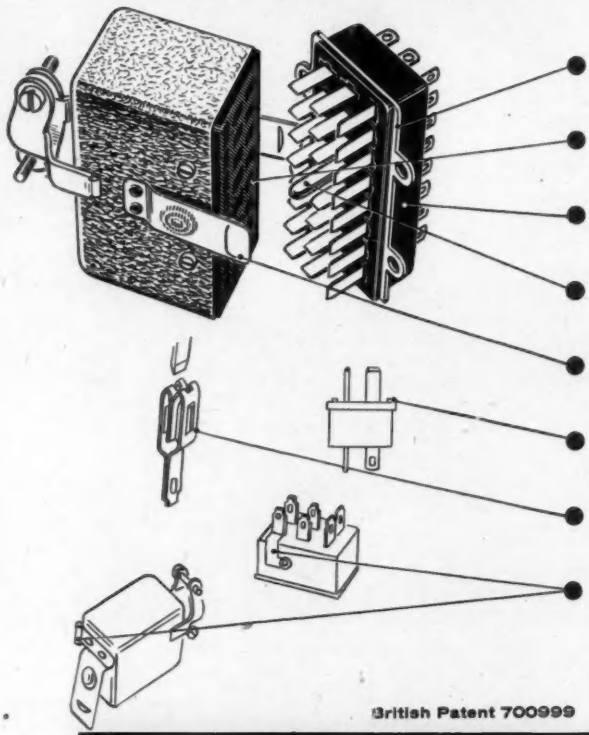

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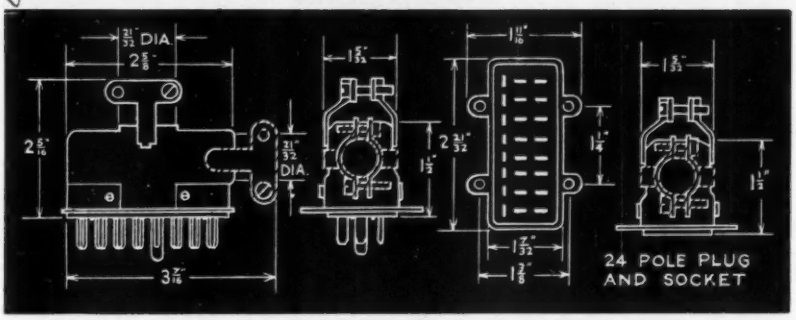

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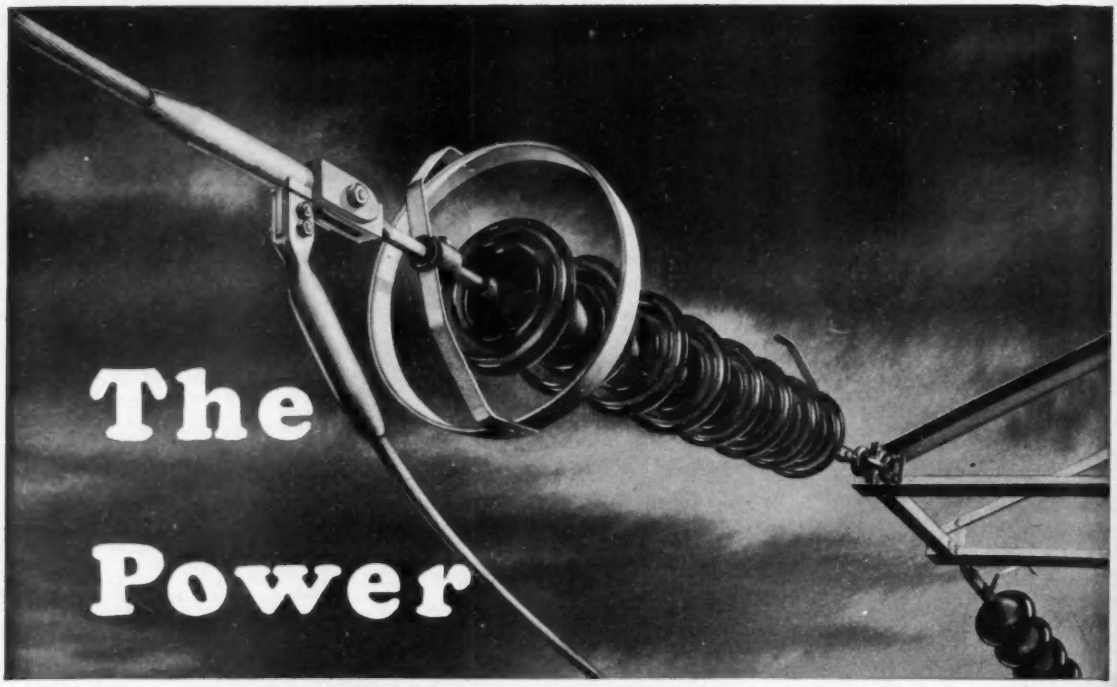

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SC177(A)/P2

Stanton Type 8F Prestressed Spun Concrete Lighting Columns at Stockton-on-Tees
Photograph by courtesy of Gilbert Cowan, Esq., A.M.I.C.E., A.M.I.Mun.E., A.R.I.C.S., Borough Engineer and Surveyor

STANTON Prestressed Spun Concrete Lighting Columns

The type shown is part of a wide range of Stanton designs approved by the Council of Industrial Design.

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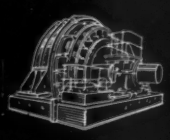

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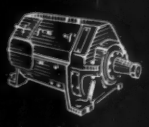
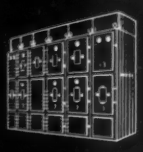


MOTORS
Type MDX motor



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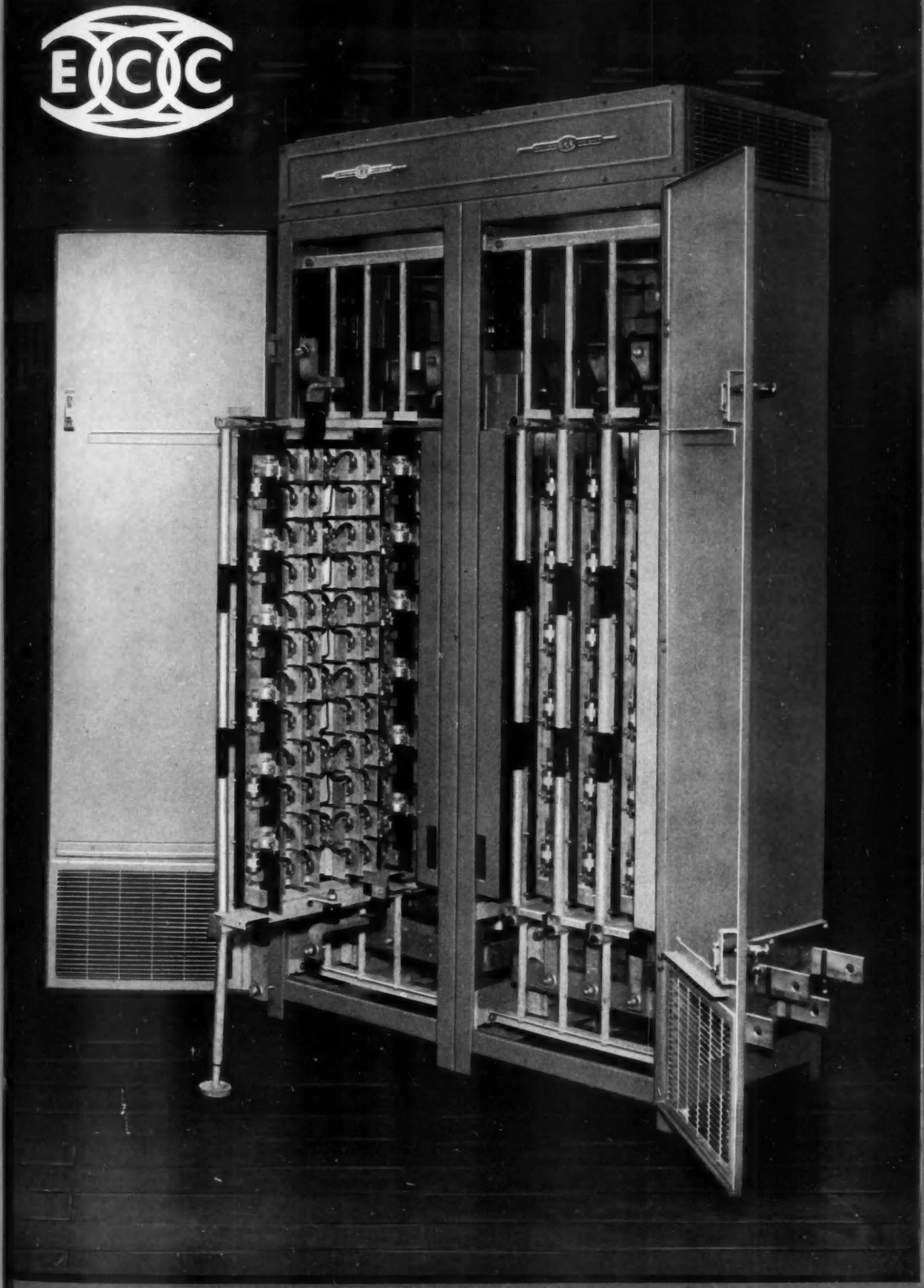

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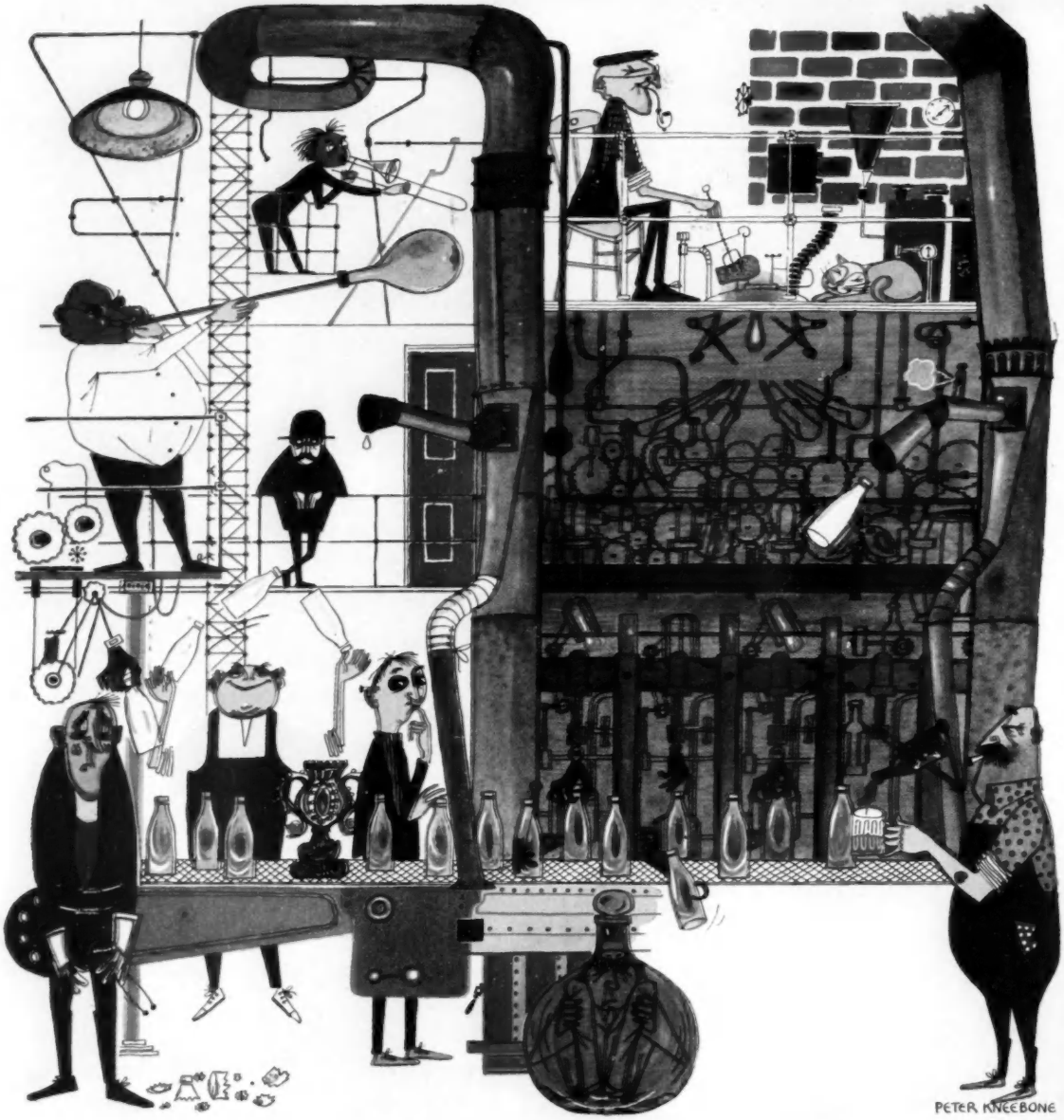

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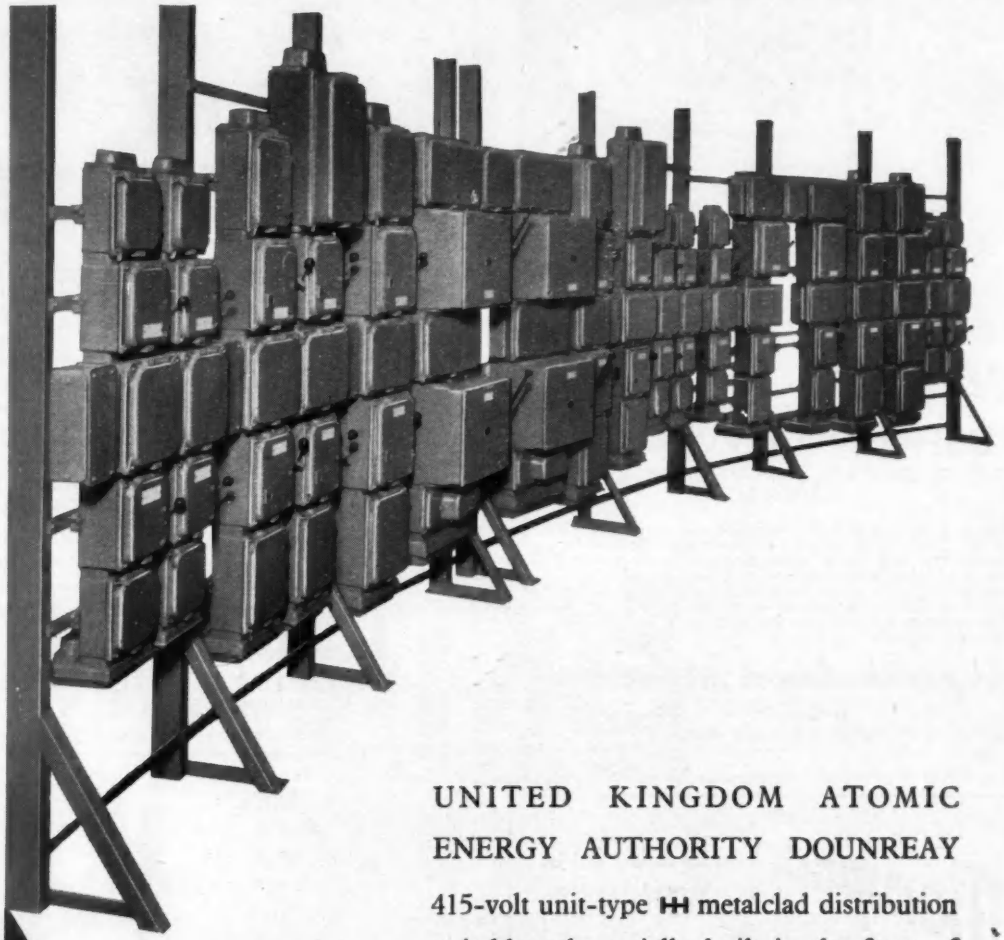

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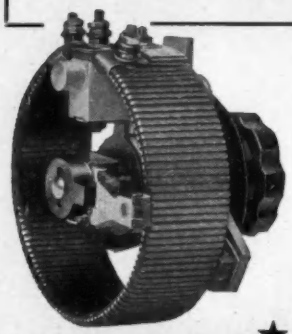

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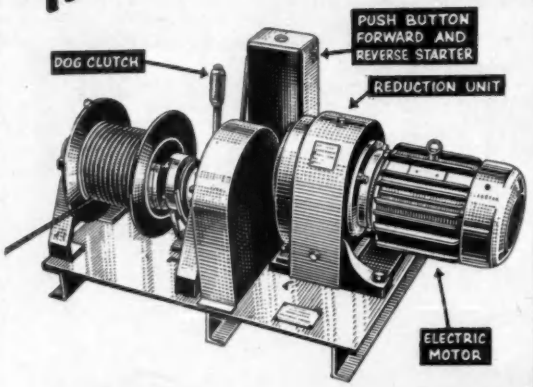

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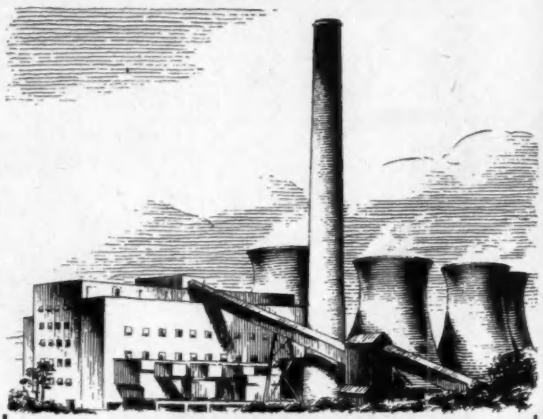

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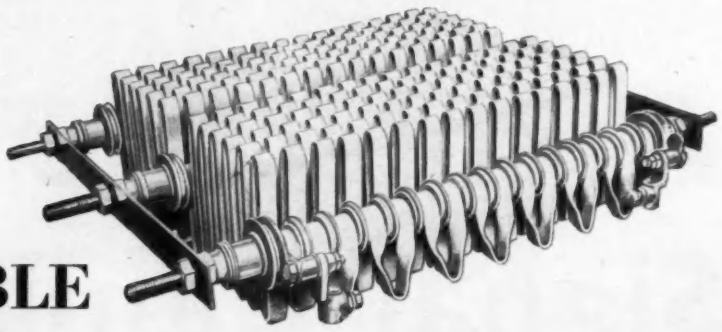

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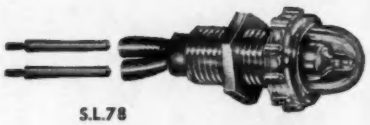
S.L.78

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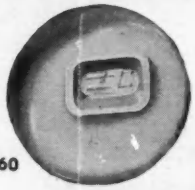
S.L.860

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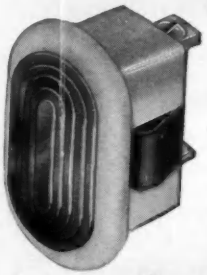
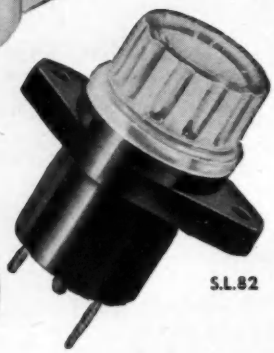

S.L.50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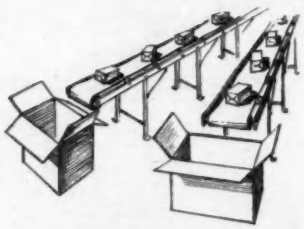

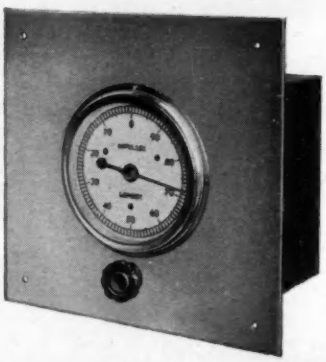

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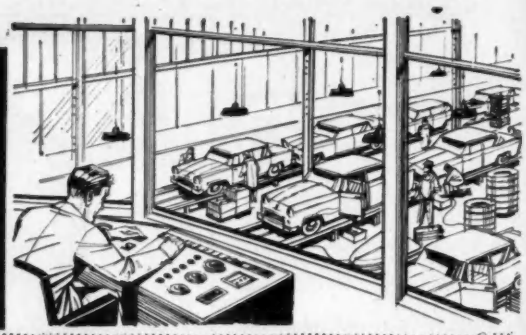

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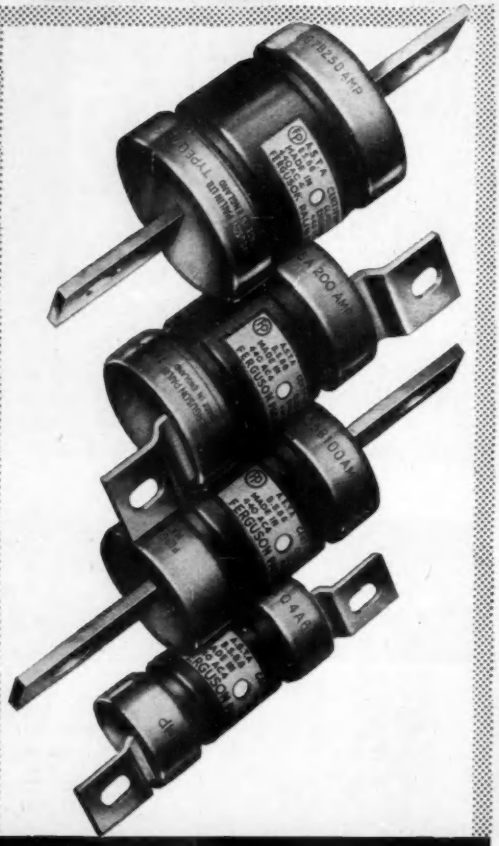

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Q4A30	30	3199	3198
Q4A60	60	3204	3202
Q5B100	100	3157	3158
Q6B200	200	3159	3160
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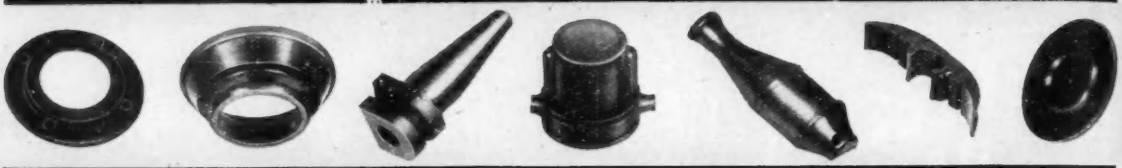

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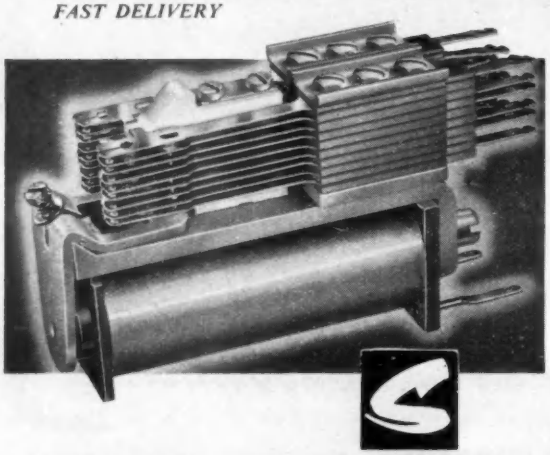

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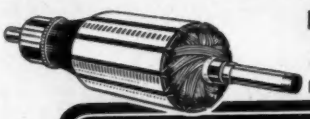

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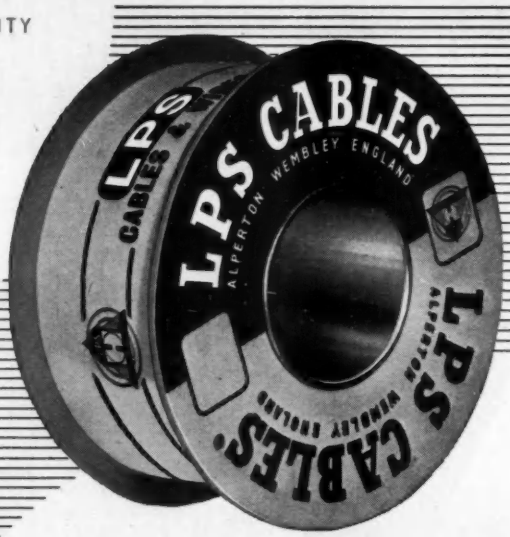

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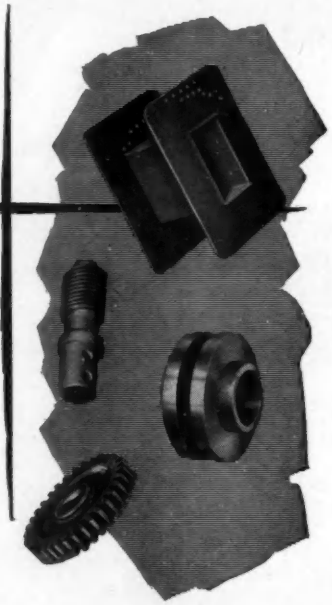

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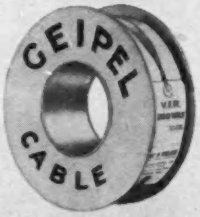
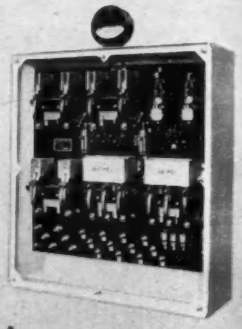


TO BRITISH STANDARD SPECIFICATIONS



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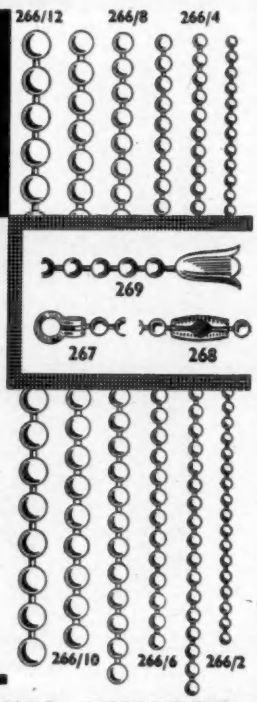

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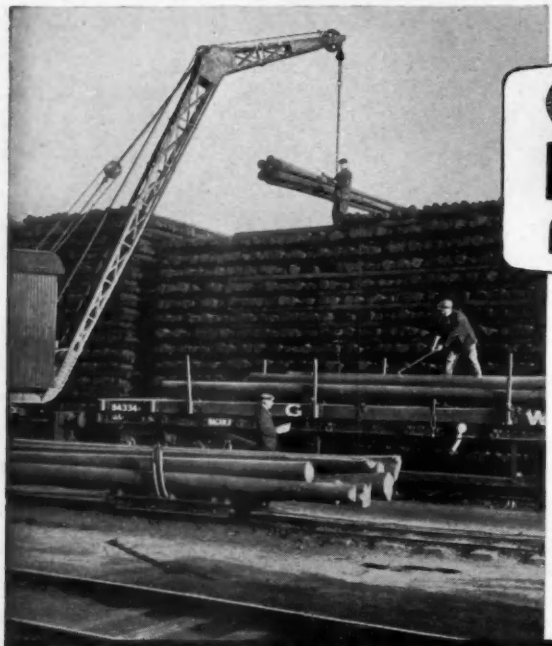

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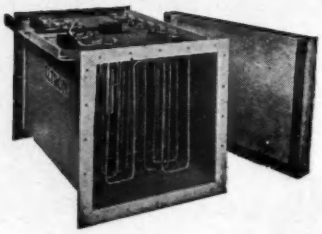

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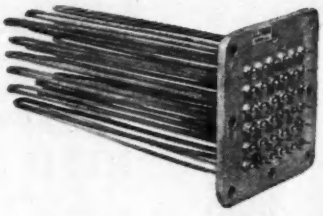

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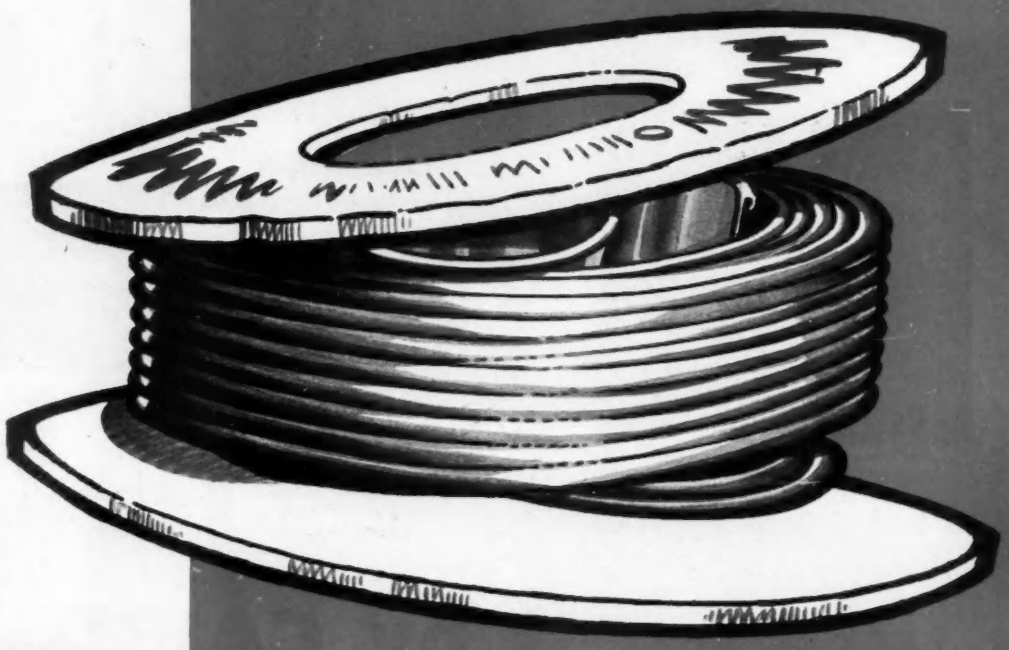

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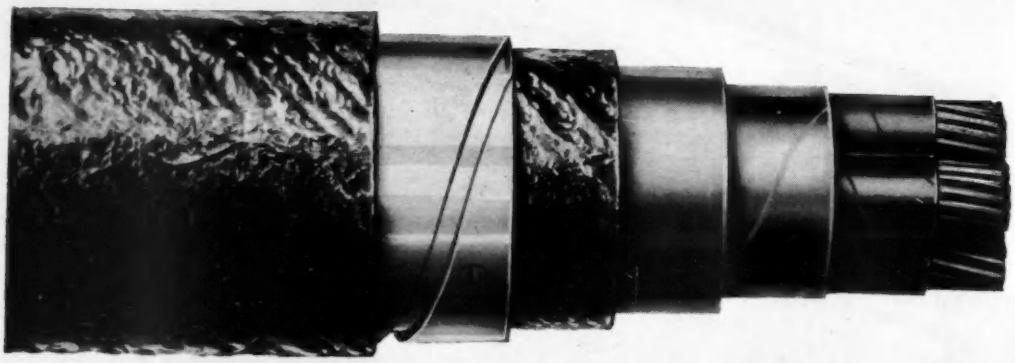

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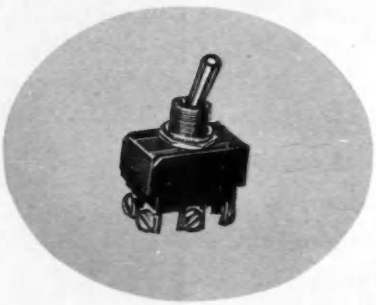

Of course we are proud of the ARROW range of appliance switches. It's the largest offered by any British manufacturer and from it designers of all types of equipment can choose switches matching up to the most exacting requirements.

The switches illustrated on this page—and many more—are described in detail in our new Catalogue J, a useful reference book for any designer.

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A21

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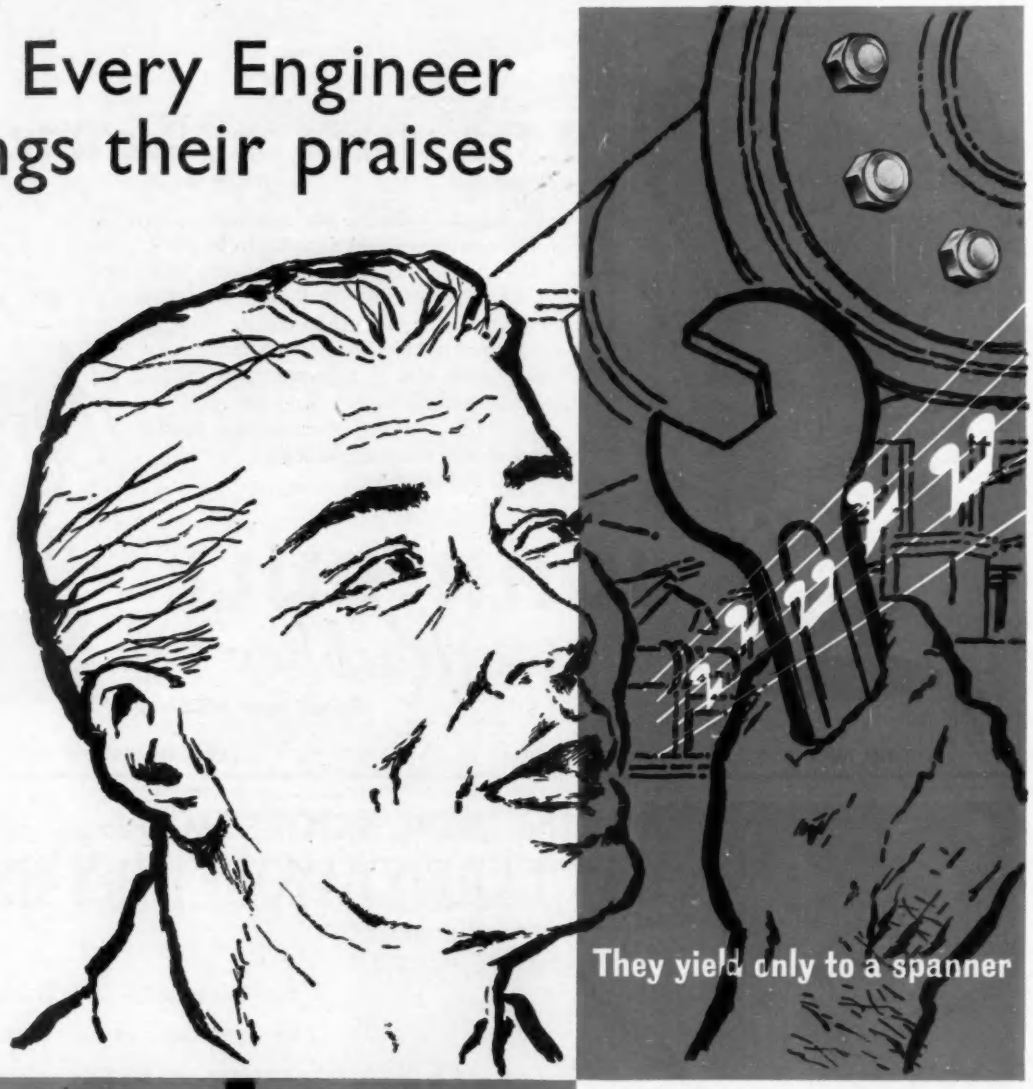

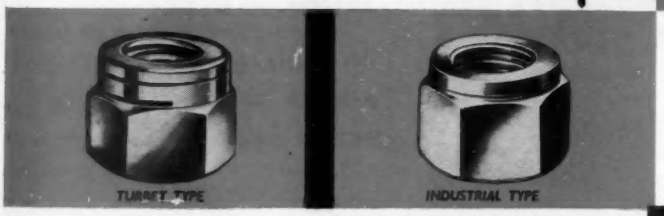

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They yield only to a spanner. Most types and sizes available from stock

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Docility, according to our dictionary, means 'teachableness'—being able to be told ! Now, nobody resents being told, so long as the teller is sufficiently well-informed and, if you don't mind our mentioning it, 'Doc' (our scientific and technical paragon) is remarkably well-informed in matters concerning rubber. '*Doc*'ility, may we suggest, is a virtue which it would pay *you* to acquire: it means putting your problems to 'Doc' and letting him tell you the answers.
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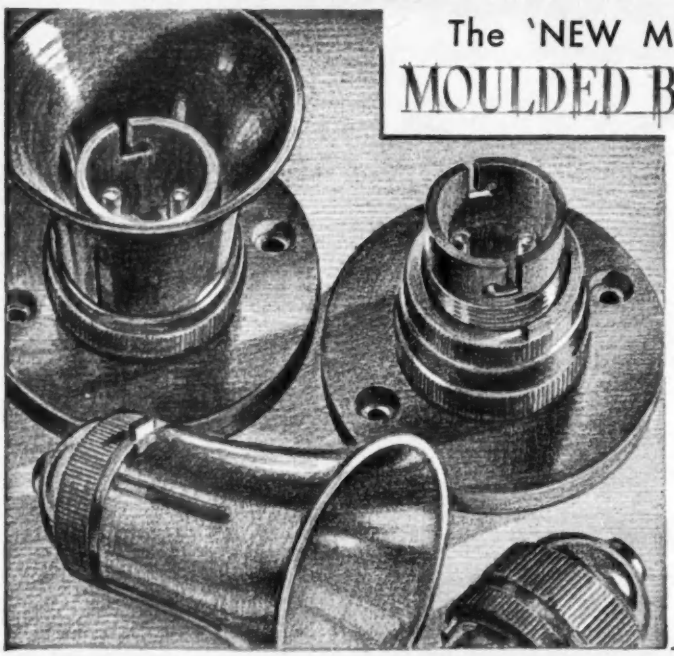

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Available in flexible C.T.S., skirted, angle batten, shallow and deep batten types, complying with B.S.52.

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We in the "Delanco" organization pride ourselves on our record in this respect. From the time of our receiving your enquiry until delivery of the goods our concern is to give you "SERVICE".

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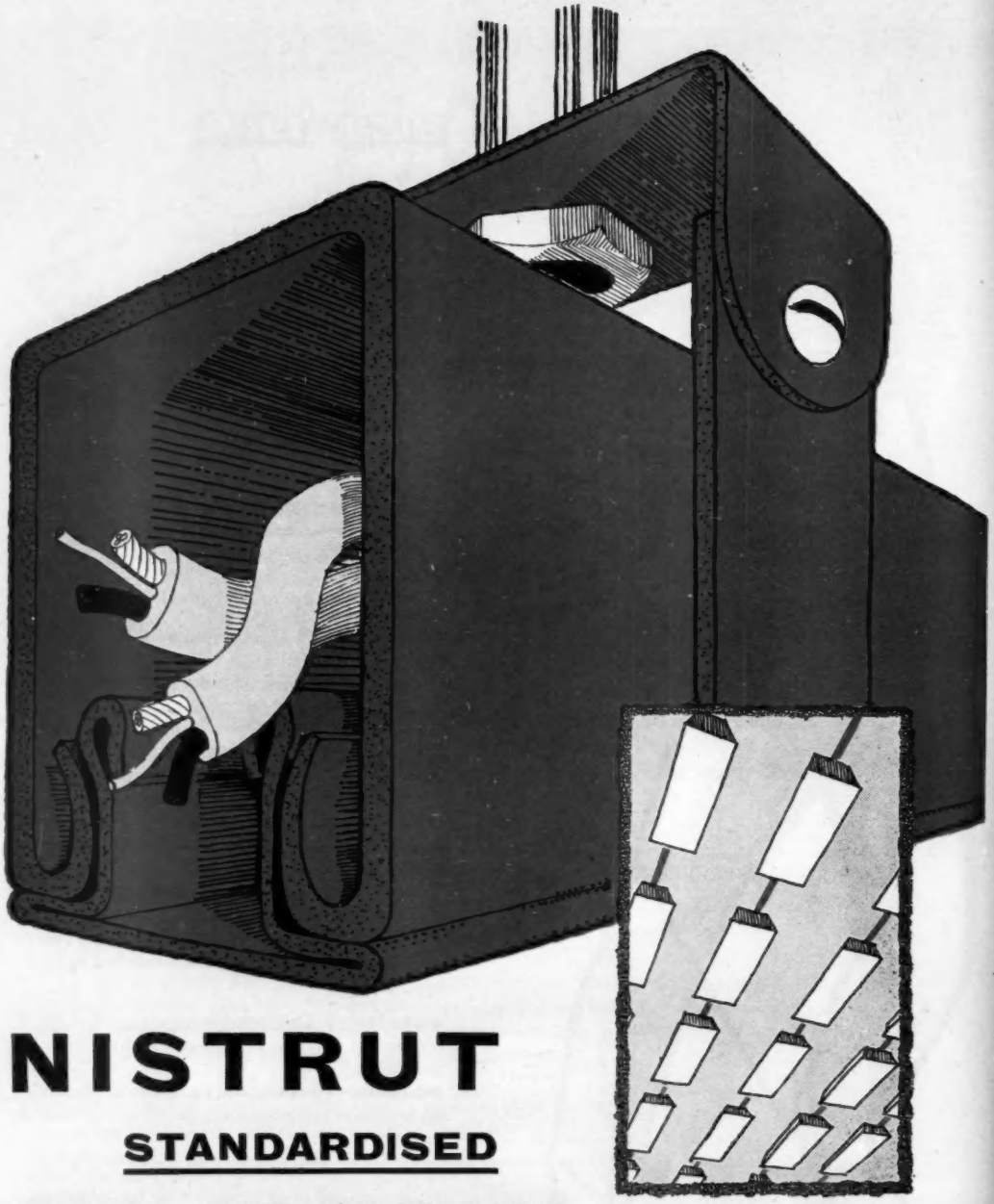

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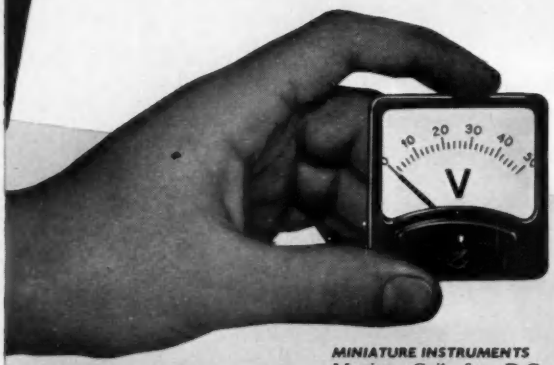

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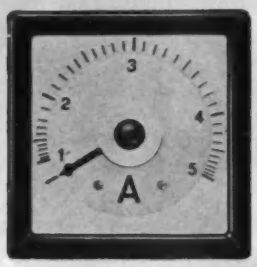

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Moving Coil for D.C. applications. Rectifier moving coil for A.F. applications. Thermo-couple operated moving coil for R.F. applications.

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This meter has a reliable and easily read register with large numerals, an impulse action which precludes "half figures" and a quick re-setting feature. This register has been approved by the Ministry of Power.

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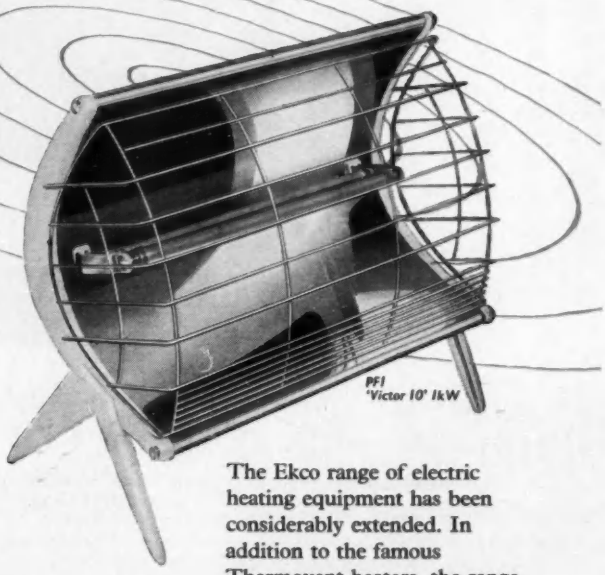
EKCO

range of Radiant Electric Fires



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'Victor 10' 1kW

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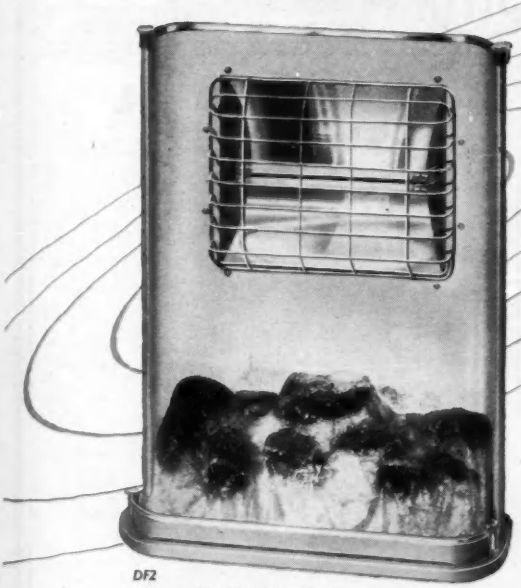
This new and fully *comprehensive* EKCO HEATING range brings you added opportunities for expanding business!



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'Flamera 20' 1kW/2kW

New Ekco Radiant Fires
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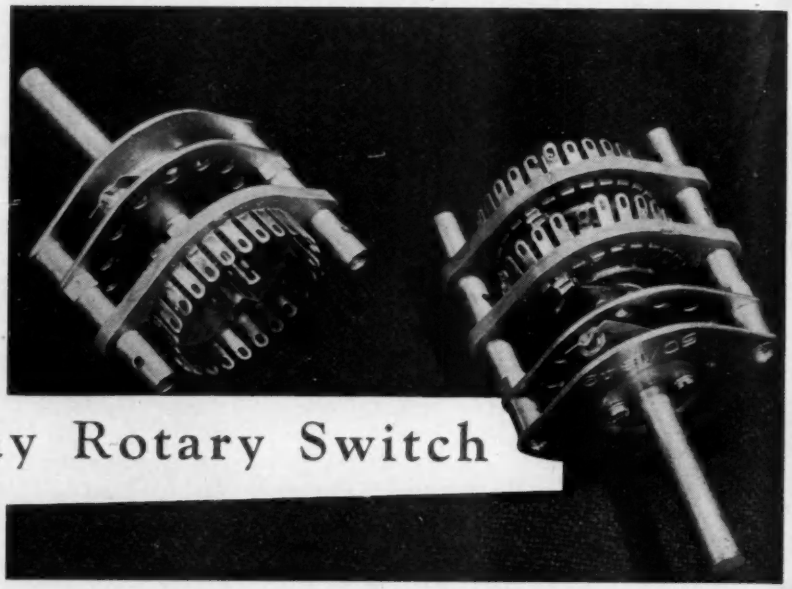

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26-way Rotary Switch

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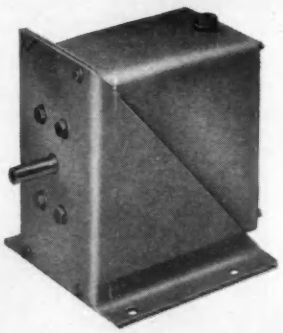

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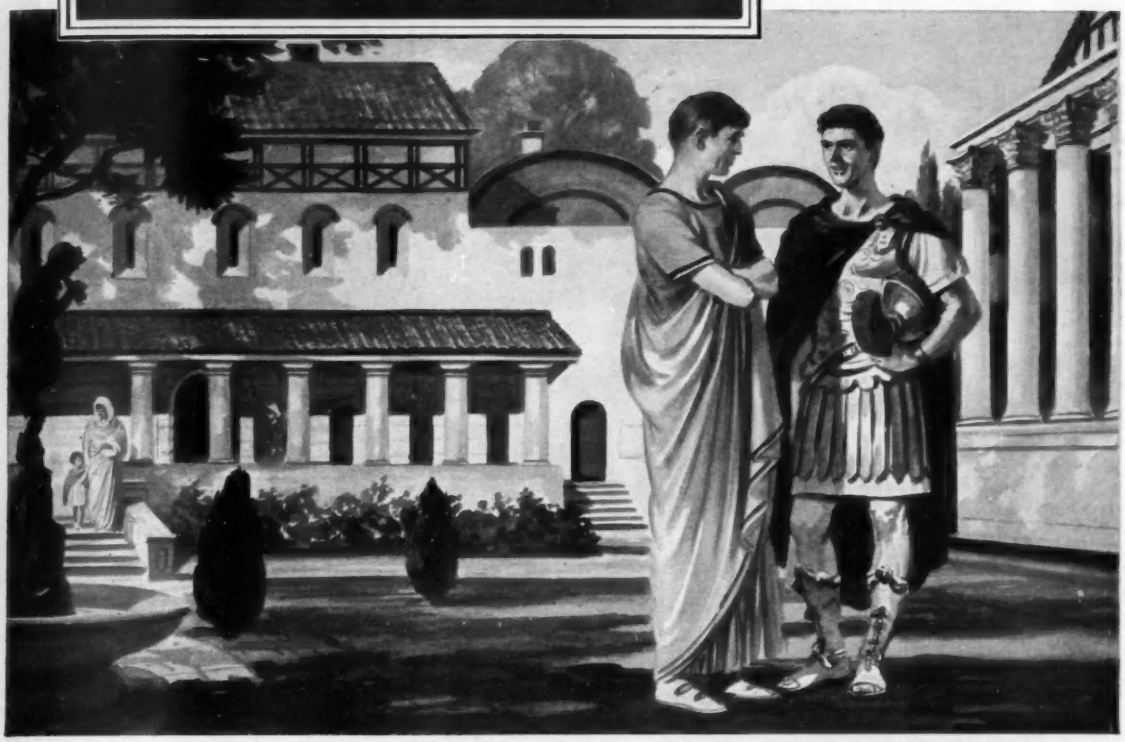

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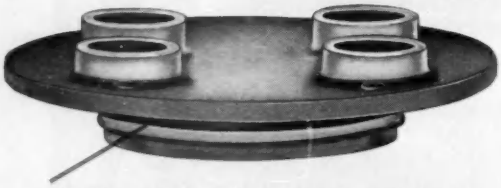

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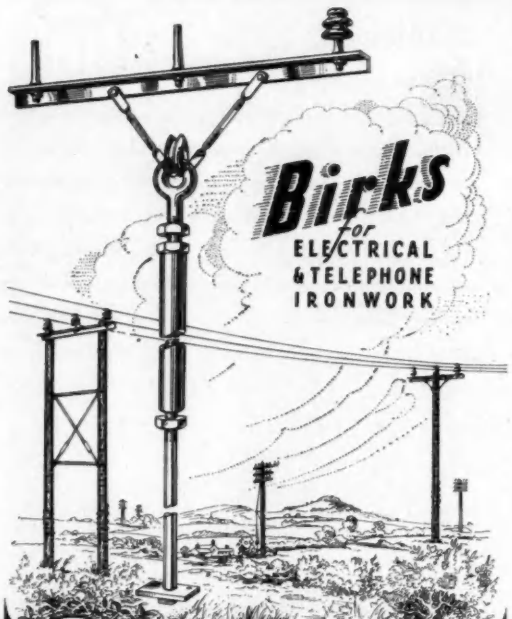

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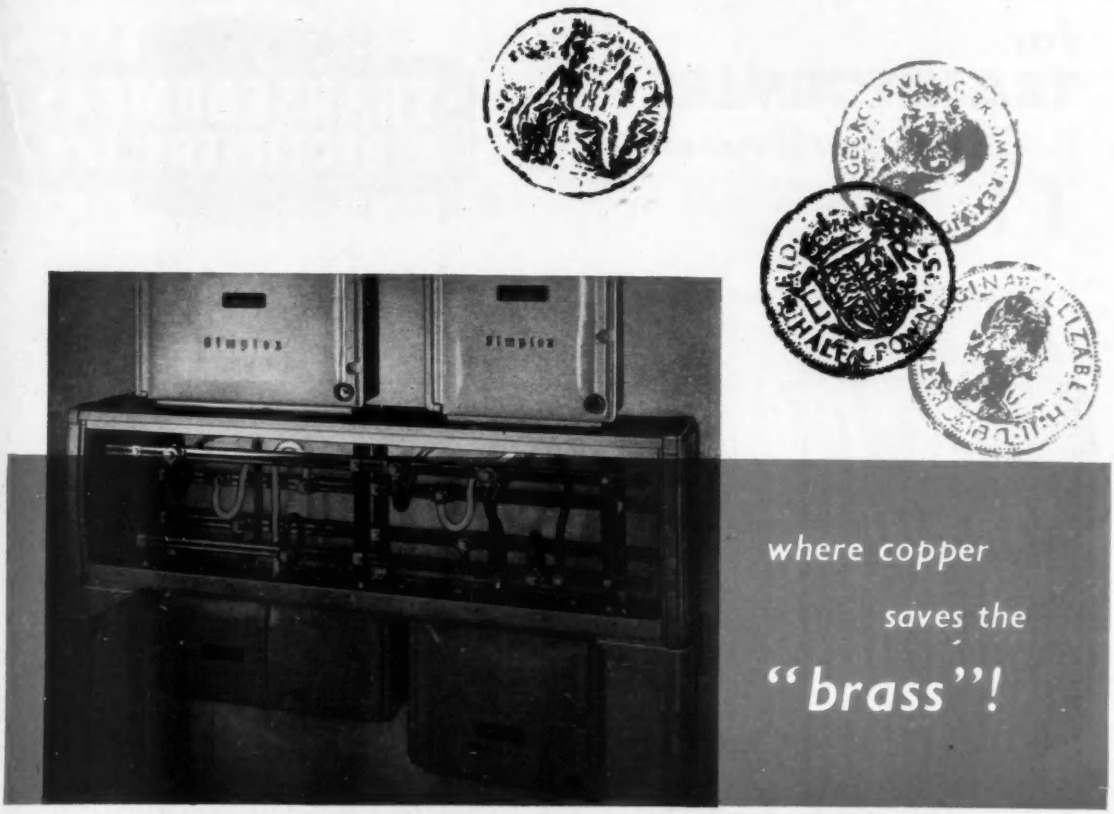

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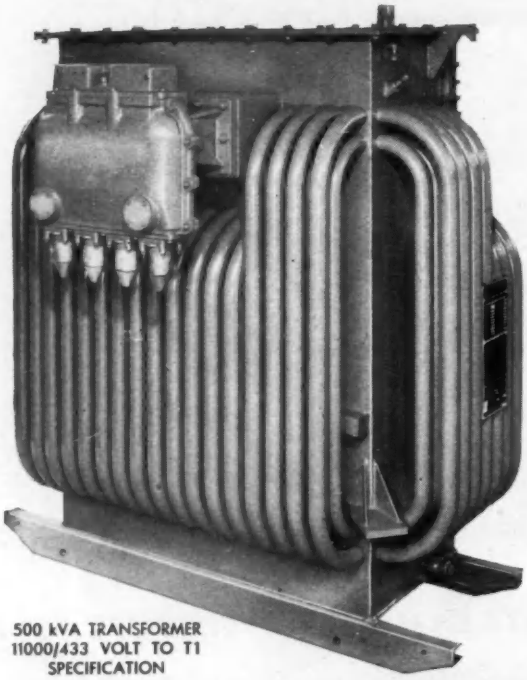

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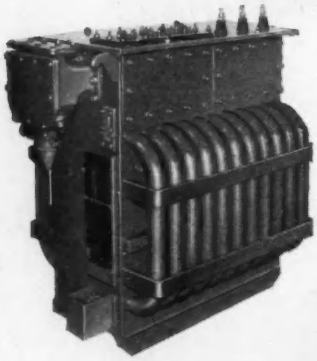

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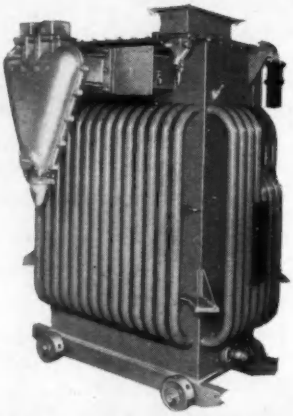

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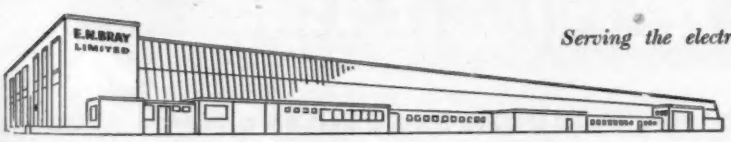

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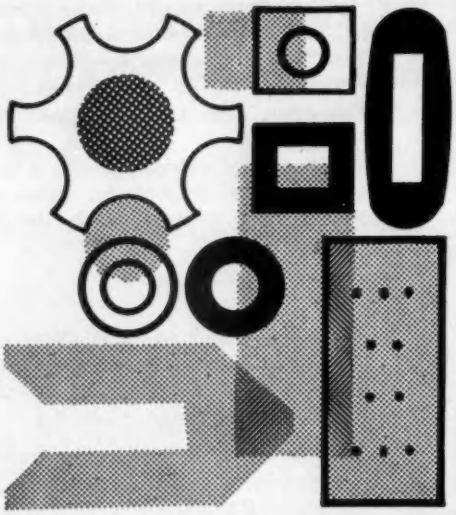

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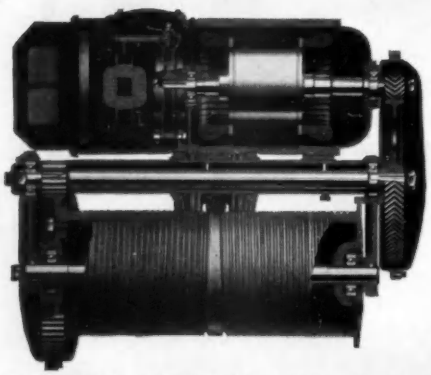

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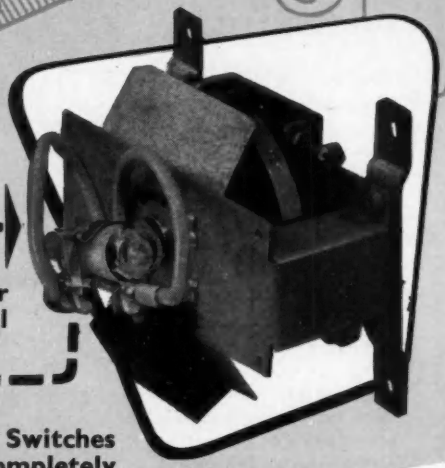

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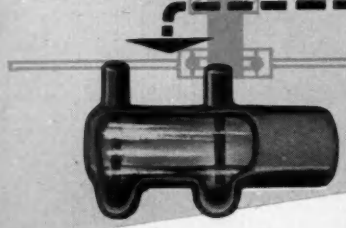

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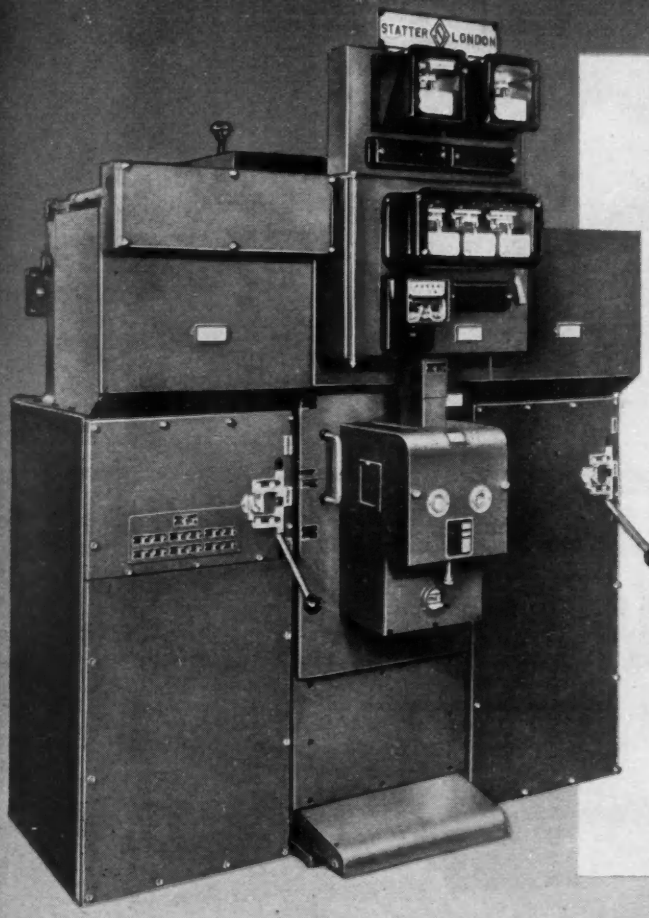

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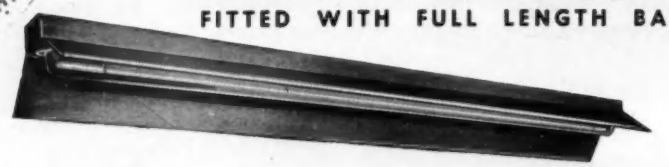

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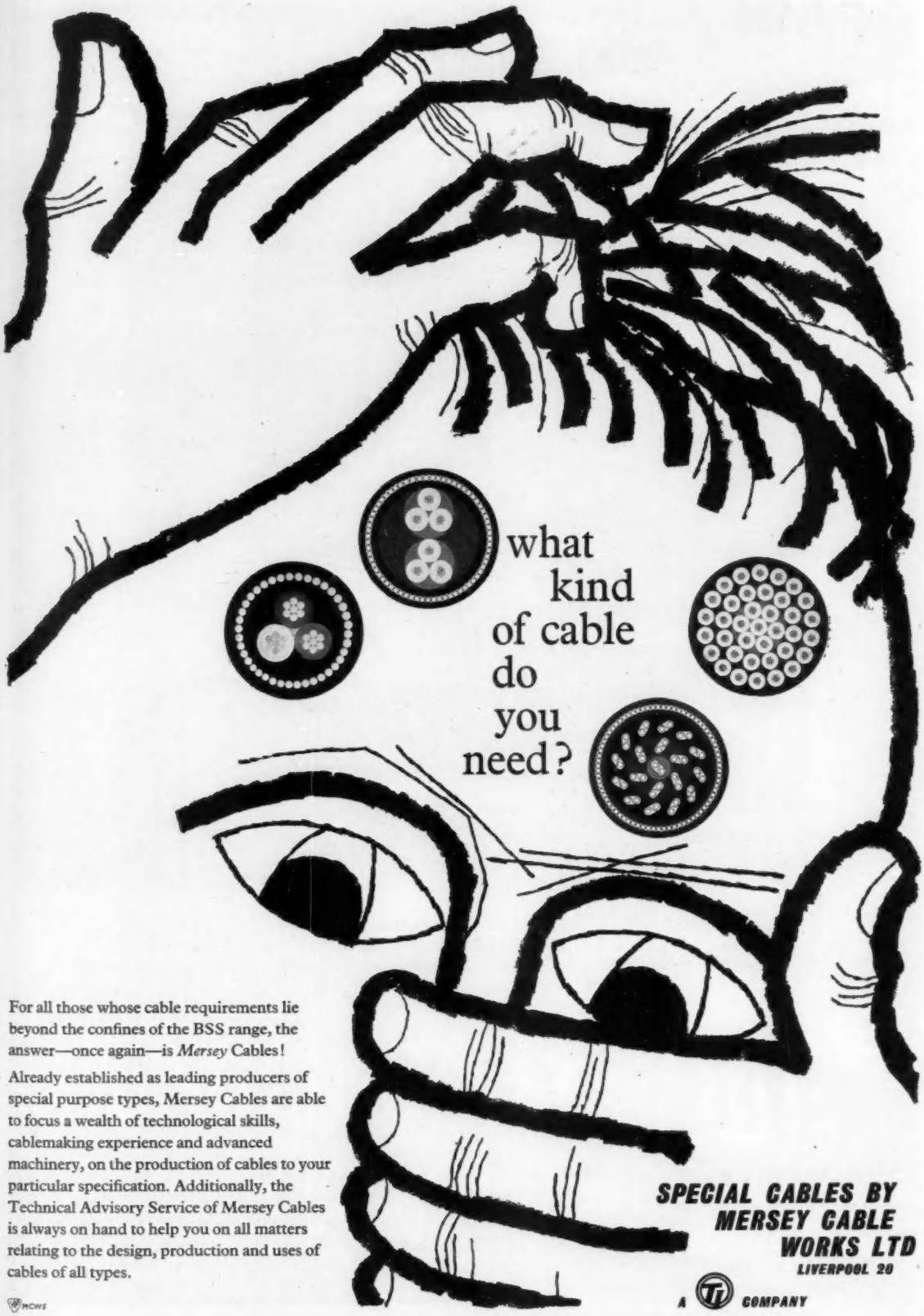

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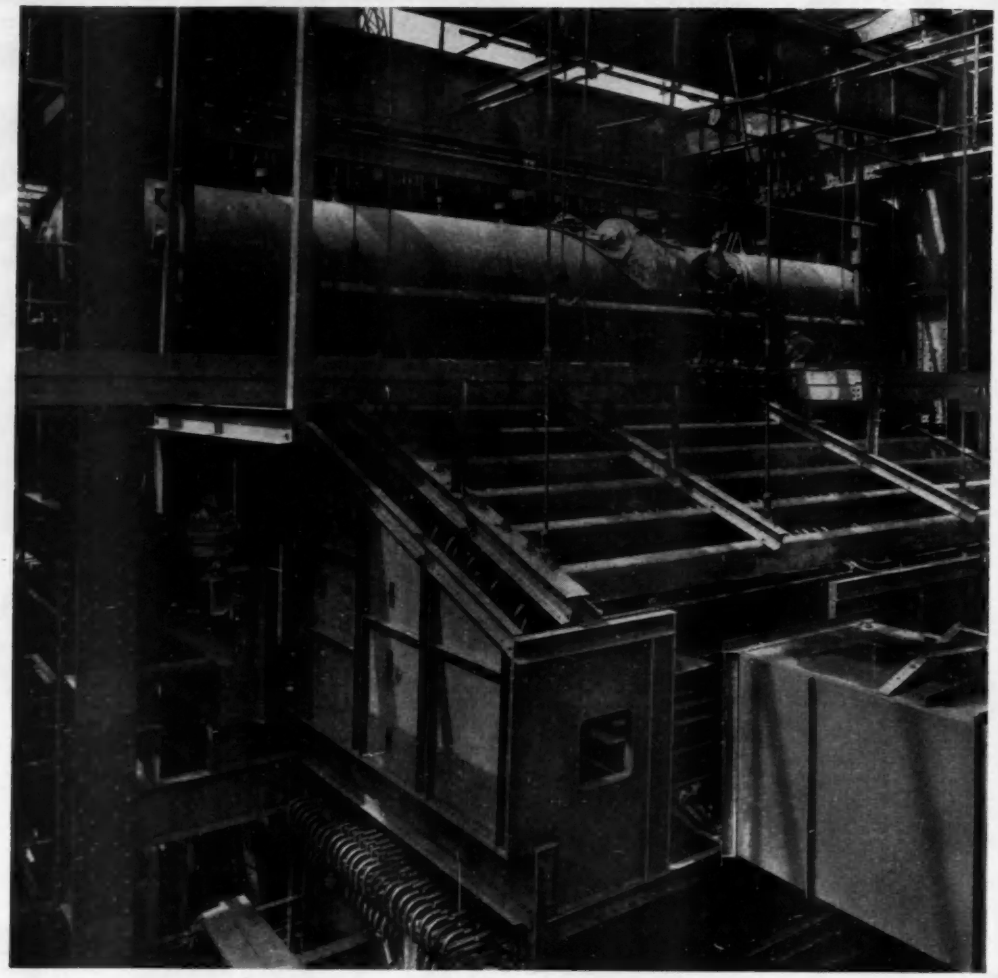

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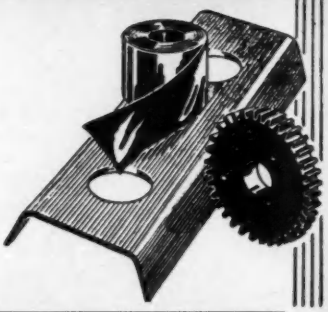

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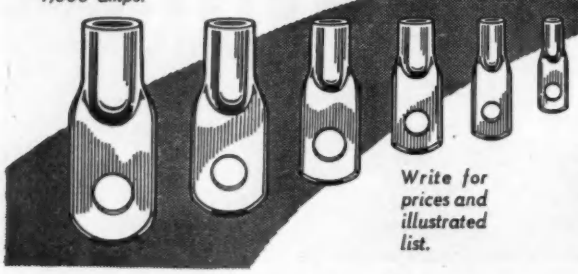

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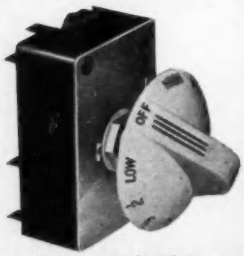

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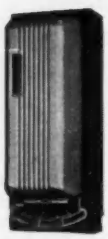

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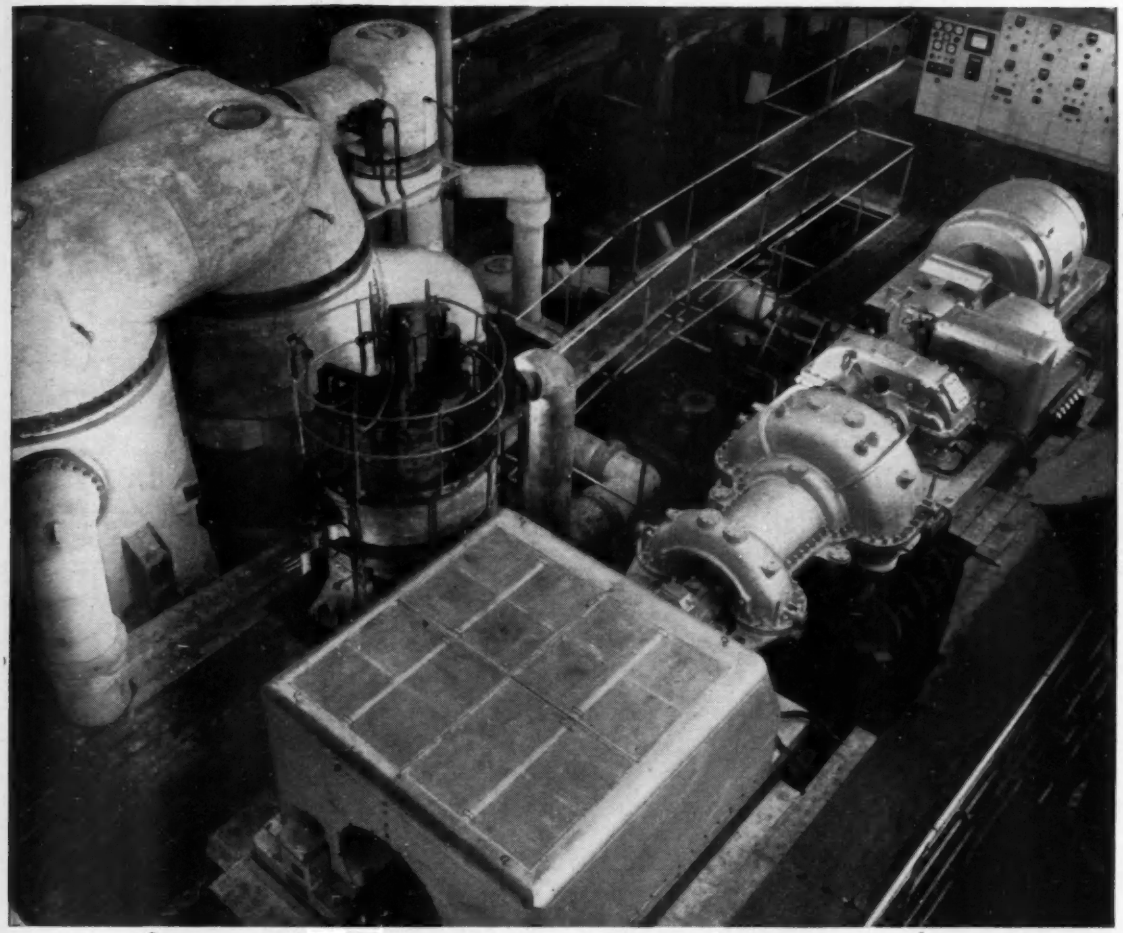

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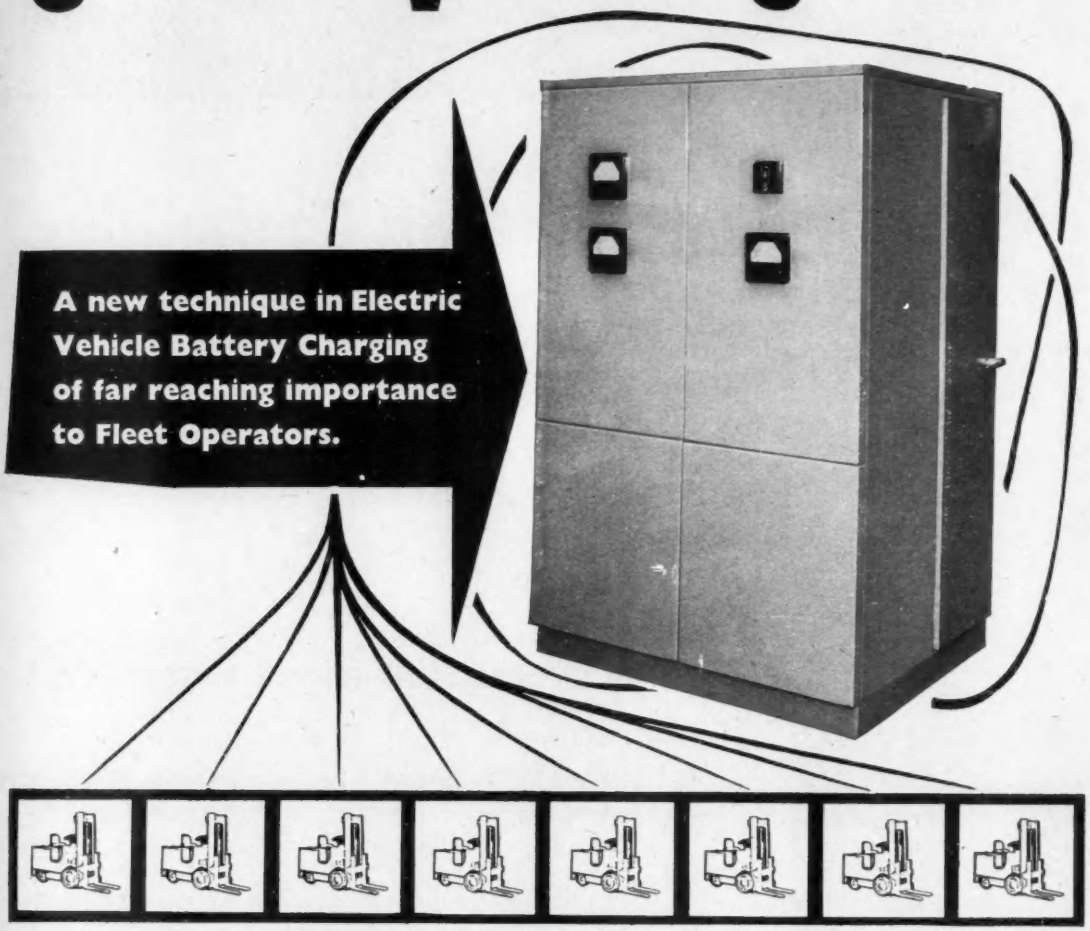

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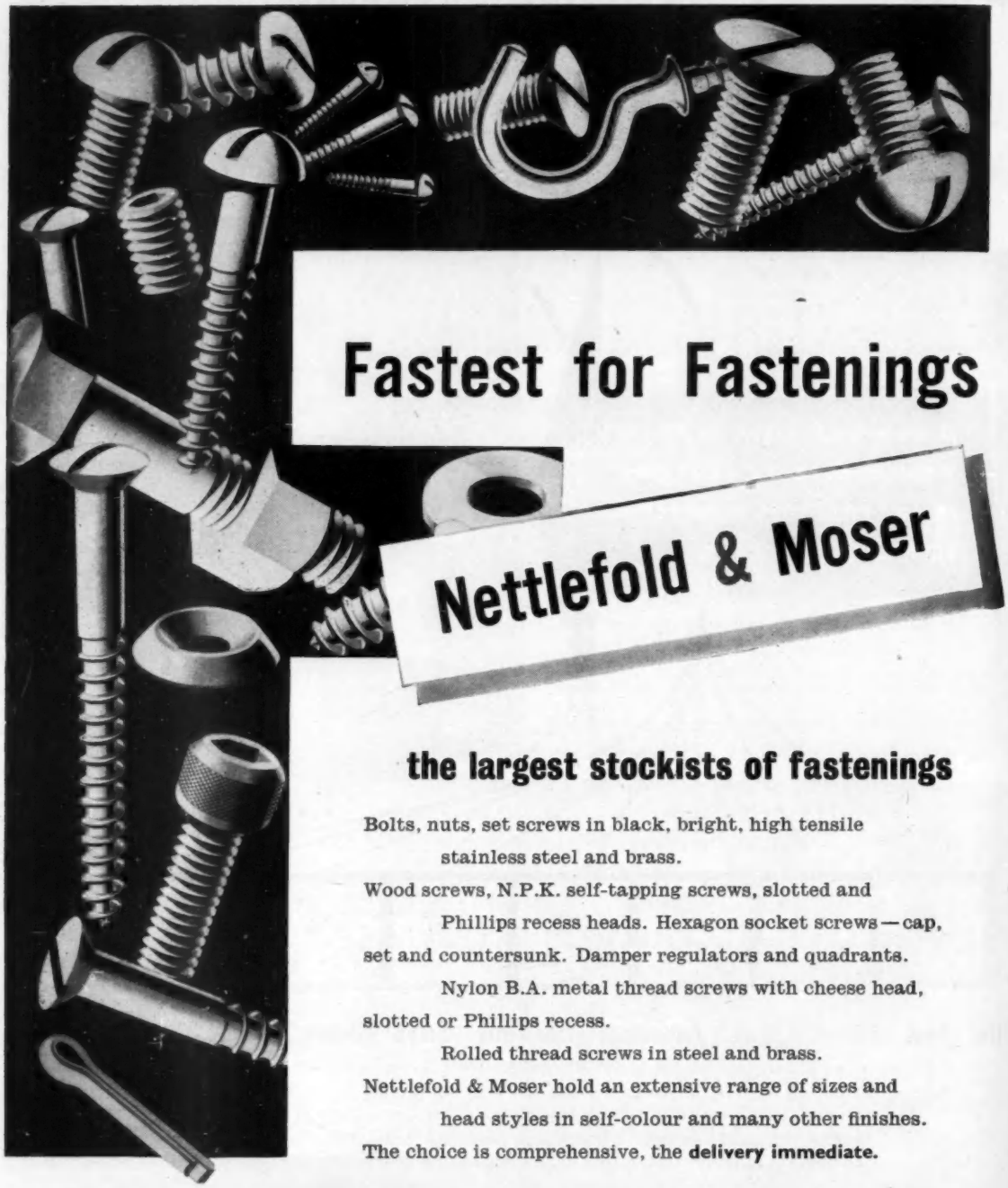

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13 JUNE
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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Development of 33 kV Networks	**1095**	The several alternative methods of developing 33 kV networks are discussed and compared by the author. The meshed network with dispersal of infeeding points is advocated, particularly because of the higher utilisation of grid transformers and the better security of supply which would be obtained
British Electrical Power Convention	**1099**	Convention programme and illustrated preview of Exhibition. Five papers are to be presented with the general theme "Electricity and World Progress—Britain's Contribution"
Control and Relay Panels	**1109**	A certain measure of standardisation of protective relay and control circuits is advocated by the authors. This would enable a rack type cubicle to be employed on power control circuits. A number of racks, each equipped with a relay or instrument, would make up one panel
Tilbury Power Station	**1117**	Official opening of new station containing six 60 MW turbo-alternators and oil/coal-fired boilers
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Synchronous Motors	**1120**	For many years little interest was taken in synchronous motors, but the position has changed radically in recent years and, although the higher initial cost of synchronous motors compared with induction motors usually precludes their use for powers below about 100 h.p., they have characteristics which have led to their increasing use where higher outputs are required
Large Power Systems	**1126**	Some 1,700 delegates from 45 countries are taking part in the 17th C.I.G.R.E. meeting which opened in Paris last week

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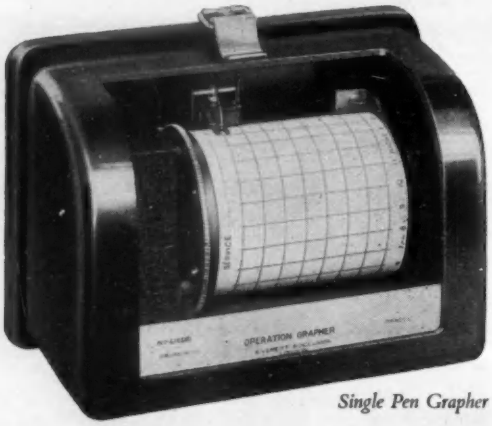

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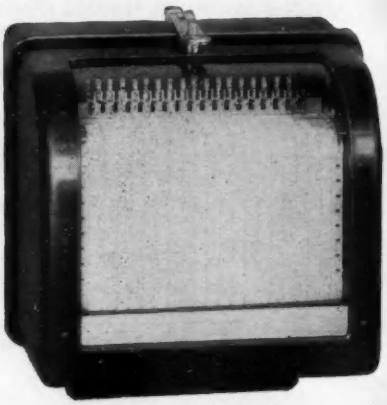

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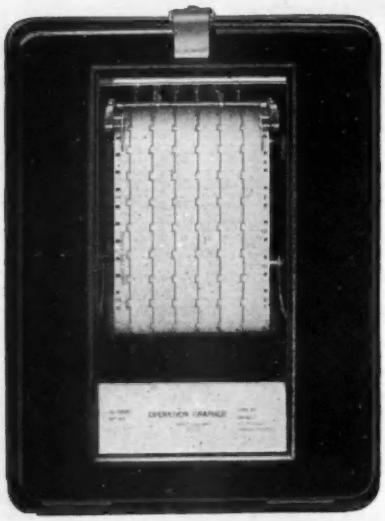

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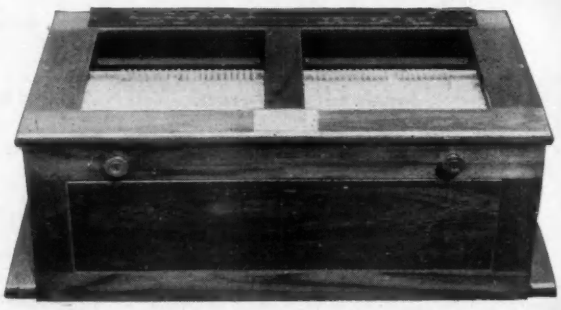

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ELECTRICAL REVIEW

13 June 1958 Vol. 162 No. 24 Established 1872

The Spirit of the Convention

WITH this year's gathering at Brighton the British Electrical Power Convention completes its first decade and an opportunity is thus offered for looking back at the proceedings over this period. Reference to the list of papers presented at the first nine Conventions discloses that there were sixty-seven altogether and the authors' names are a guarantee of their soundness. They form a valuable record of British electrical activity and development during the last ten years as well as reliable pointers to the future. In the last-mentioned respect we may recall the 1955 Convention at Brighton when a number of leading authorities ventured into prophecy and endeavoured to outline the possible course of development in electricity generation and in the electrification of some of the country's major industries. Coupled with this there were papers on careers in the three main branches of the electrical industry—supply, manufacturing and contracting—by representatives of those sections.

Earlier, at Torquay in 1953, the theme had been "Electricity and National Prosperity" and the nine papers then presented gave a good idea of the ubiquity of electrical service in industry, with special reference to food production. The 1956 Convention, again at Torquay, was of a more specialist character, nine of the ten papers relating to electric rail and road transport. These were opportune because they were presented just after the publication of the plan for the modernisation of British Railways and just before the White Paper on the subject. For the rest, the papers have ranged over the whole electrical field and at most Conventions the domestic side has received attention.

It will be seen that the Convention has provided opportunities for surveying progress and possibilities in a way that no other single body in the industry could have done. Representatives of the various interests in the electrical industry have been enabled to learn what was going on in sections outside their own, to present fresh views on the matters discussed, and generally to relate their own activities to those of the rest of the industry. That is the main reason for the existence of the Convention and we think that it has largely been fulfilled.

The social side is no less important. After all, the industry is manned by human beings and, quite apart from the purely technical aspect, there are differences in policy. What is good for one section may, probably quite unintentionally, operate adversely upon another. Personal contacts made during the Convention may go a long way towards removing sources of irritation and smoothing the path of progress. We know of no other industry in which such good relationships exist between the various interests and we believe that even if these did not originate with the Convention they have been immensely strengthened by it.

UNDESIRABLE SEGREGATION

In its leading article the June issue of *Public Service* (the journal of the National and Local Government Officers' Association) deals with the "silent revolution" taking place in the gas and electricity supply industries. By this the journal means the reorganisation of the business which, in achieving economy, leads to redundancy of staff. While it is admitted that the immediate impact on individuals is softened by ensuring that they are not financially worse off, it is contended that opportunities for betterment are reduced and possible remedies are considered.

One is that all higher posts should be filled from within the industries, and indeed there is much to be said for this form of "closed shop." But there is another aspect to be taken into account. Is it good for nationalised industries to isolate themselves in this way from the outside world? Is there not a good case for free movement between "private" industry and public bodies? In this way ideas and methods can be interchanged and closer working established between them. Electrically, anyway, the supply authorities are only a section (albeit a large one) of the whole industry and no section should be sufficient unto itself.

GAS PROSPECTS

Having referred last week to the gloomy prognostication on the gas industry published by the *Economist* under the title "To-day's Dearest Fuel?", we feel bound to follow with a note on a second article headed "Tomorrow's Cheapest Fuel?" in which the *Economist* presents the other side of the shield. It comments on the gas industry's endeavours to improve its productive efficiency by alternatives to the present carbonisation methods, including the gasification of small coal, and by improved distribution involving the construction of a national grid.

It is recognised that the realisation of these plans will take some years but, says the *Economist*:— "Chances of a prosperous tomorrow will not excuse the gas industry from short commons and making do to-day. But the chances are real and invigorating; as real, say, as economic nuclear power, no more remote, and eventually capable of providing energy a good deal cheaper." The last phrase is ambiguous: does it mean cheaper gas than at present, or gas cheaper than nuclear energy?

ENGINEERING INSTITUTIONS

The Institution of Civil Engineers was founded in 1817 to facilitate the acquirement of knowledge necessary in the civil engineering profession and for promoting mechanical philosophy. The Institution was incorporated by Royal Charter in 1828 and the profession of a civil engineer as distinct from that of a military engineer was defined as the art of directing the great sources of power in nature for the use and convenience of man. In 1847, the Institution of Mechanical Engineers was established and the Institution of Electrical Engineers was founded in 1871. The total membership of the "Civils" is about 23,000, the "Mechanicals" have 48,000 members and the "Electricals" have about 42,000 members. The grand total of members of the three Institutions is about 100,000, allowance being made for those who are members of more than one Institution.

Although civil engineering originally covered both mechanical and electrical engineering, the term is now used in a more limited sense. The activities of the Institution of Civil Engineers are now quite distinct from those of both the other major Institutions but its examinations still provide for entry by electrical and mechanical engineers. In most Commonwealth countries there is only one engineering institution to cater for all engineers but we think that it would be impracticable to have the same in this country where the numbers in each institution are so great. But, as Sir Arthur Whitaker said at the annual dinner of the Institution of Civil Engineers last week, that is not to say that there should not be some kind of joint organisation to formulate engineering policy and control the profession.

PATENTS AND INVENTIONS

Congestion in the Patent Office continues, although towards the end of 1957 (according to the Comptroller-General's report reviewed in this issue) there was some alleviation. The Patents Office suffers in common with all branches of technical activity from inability to recruit sufficient numbers of qualified men, especially, it is said, electronic engineers. Nevertheless it was found possible to augment the examining staff to a substantial extent by means of an intensive recruiting drive.

Electrical inventions again formed the subject of a large proportion of patent applications; the report makes particular reference to fuel cells and semiconductor devices. Over 300 primary specifications relating to electricity supply systems were accepted and 222 in connection with dynamo-electric machines. Telephone, telegraph, radio and television inventions were again prominent; over 760 primary specifications in this field were sealed.

It is evident from the report that inventive genius is not lacking. What is not so clear is when the Patent Office will be able to keep abreast of it.

The Convention President

Next week's British Electrical Power Convention to be held at Brighton will be presided over by **Sir George Nelson, Bt.**, whose portrait appears on the opposite page. Sir George is an outstanding electrical engineer-administrator. He has been President of both the Institution of Mechanical Engineers and the Institution of Electrical Engineers and for twenty-eight years has successfully controlled the destinies of the English Electric Group of Companies. In a wider sphere, he has been president of the Federation of British Industries and has a fine record of public service, especially in the field of education.

Sir GEORGE NELSON, Bt., F.C.G.I., D.I.C., M.I.Mech.E., M.I.E.E.

PRESIDENT OF THE BRITISH ELECTRICAL POWER CONVENTION

DEVELOPMENT OF 33 kV NETWORKS

Comparison of Alternative System Arrangements

By U. G. KNIGHT, B.Sc.Eng., A.M.I.E.E.*

THE electrical power supply system in this country is made up of networks performing five functions and, in the main, constructed for five voltage levels. These are:

(*a*) The 275 kV supergrid used to interconnect groups of generating stations. The whole of this system will normally operate in parallel.

(*b*) The 132 kV grid interconnecting generating stations and bulk supply (grid) points within the groups connected by the 275 kV supergrid.

(*c*) The 33 kV (and less frequently 66 kV or 22 kV) sub-transmission networks distributing power from the grid points or power stations. These networks normally operate in parallel over relatively small areas (between, say, 5 and 500 square miles).

(*d*) The 11 kV and 6·6 kV (h.v.) distribution networks, which in turn distribute power from the substations stepping down to these voltages from the 33 kV network. Some consumers are supplied at these voltages. Parallel operation is restricted due to the necessity to limit fault levels and, in many cases, protective gear limitations.

(*e*) The 415 V local distribution networks supplying power to the individual small consumer. Usually, the network is made up of feeders operated radially from the infeeding substations, but in the more heavily loaded areas a fully interconnected system stretching over, say, a tenth to half a square mile may be found.

This article compares alternative ways of developing the 33 kV network and suggests that the meshed network with dispersal of infeeding points described below has advantages over other ways.

Most 33 kV circuits, whether overhead or underground, are rated at between 15 and 25 MVA. It is now an accepted standard of supply that loads of these magnitudes should be maintained during and following any single equipment fault. It follows that, in general, some form of duplication of each 33 kV circuit should be provided, either by a second circuit in parallel or by supplying a single circuit from each end. Hence, 33 kV networks are generally made up of the basic arrangements shown in Fig. 1.

The more usual arrangements are those shown in (a), (b) and (c). In these, a duplicate supply to each substation is provided from one bulk supply point, equipment such as busbars and grid transformers being duplicated at the bulk supply point.

The arrangement in (e) is found sometimes in cities connecting, say, a power station on an old site in the urban area, with a grid point on the city outskirts, and sometimes connecting a number of small generating stations, which at one time supplied local towns, with one grid point. Frequently the generating plant sited in such positions is of low merit order, and some attention has to be paid to the firmness of supply under off-peak conditions. The meshed network with dispersed infeeds, shown in (d), has, until recently, been used infrequently in this country at the 33 kV voltage level. It will be discussed in more detail below.

Meshed Network with Dispersed Infeeds

This method of development is, in some ways, a logical extension of the principles followed in lower voltage

* Merseyside and North Wales Electricity Board.

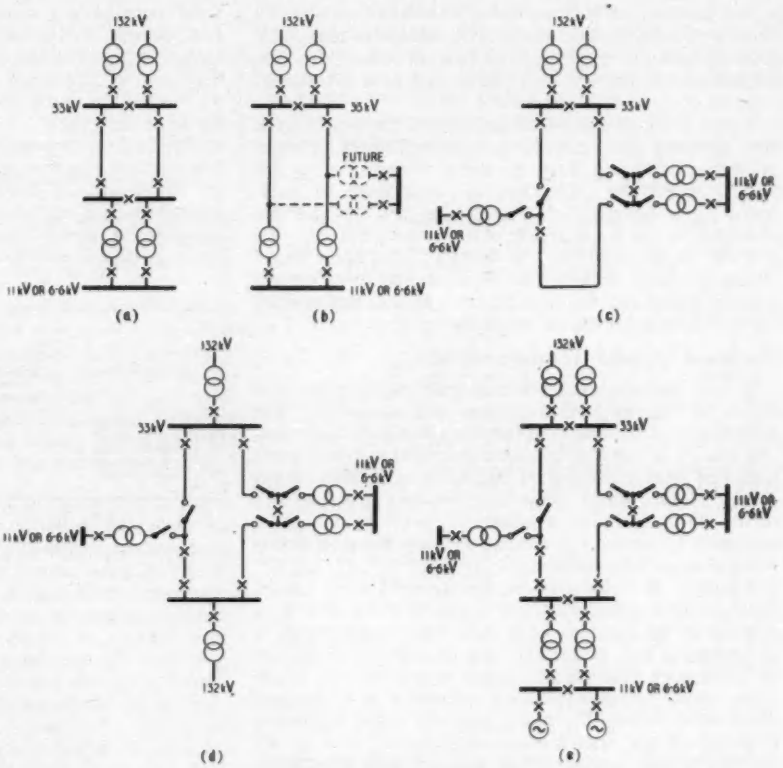


Fig. 1.—Alternative 33 kV network arrangements

(a) Duplicate circuit. (b) Transformer feeders. (c) Ring feeders. (d) Meshed network with dispersed infeeds. (e) Ring circuit with generation. By way of illustration, single breaker and ring main unit 33/11 kV or 33/6·6 kV substations are shown in (c), (d) and (e); fully breakered substations could equally well be used

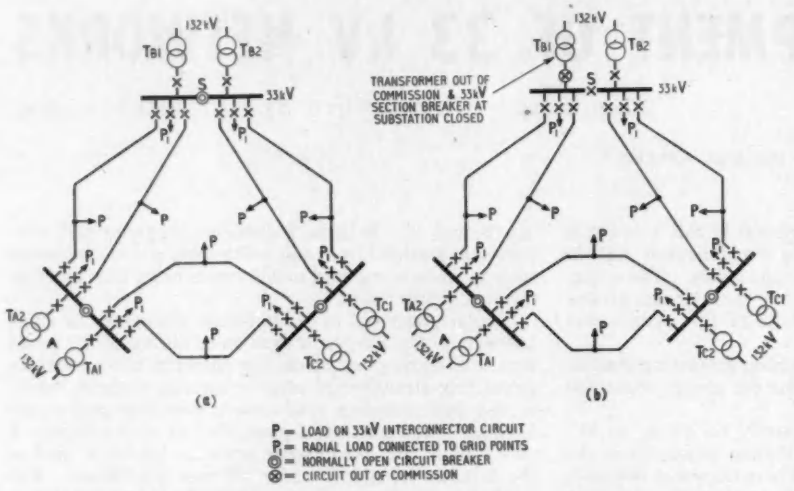


Fig. 2a.—Meshed network with dispersed infeeds *Fig. 2b.—Transformer outage conditions*

planning. At 11 kV, 6·6 kV and particularly 415 V, networks are usually reinforced by the installation of a transformer stepping down from the next higher voltage level. As load density rises, it becomes possible to extend this principle to the 33 kV network. Reinforcement of this network should then generally be provided by the establishment of new grid points rather than by increase in the capacity of existing ones with additional 33 kV circuits out of these grid points. Extension of the 33 kV network should be limited to that necessary for the connection of the new grid points and new substations stepping down to 11 kV or 6·6 kV.

Again, as 11 kV and 6·6 kV circuits are frequently made firm by using these circuits as interconnectors between substations stepping down to these voltages, so 33 kV circuits should be made firm by using them to interconnect grid points, thereby obtaining the best possible ground coverage for each mile of circuit constructed. To give an "immediate firm" as against "switchable firm" supply on these circuits, two or more grid transformers must be paralleled via the circuits. Hence, the meshed network with dispersed infeeds is obtained.

Practical Circuit Arrangements

In practice, single-transformer bulk supply points, as shown in Fig. 1d, are sometimes not economic. The greater part of the site establishment, ancillary equipment and 132 kV line charges are incurred whether one or more than one grid transformers are sited at a bulk supply point. Hence, whilst single-transformer grid points will occur, particularly as a stage of development, it is necessary to extend the method to cater for grid points with two or more transformers.

A pattern of 33 kV network development which can be consistently adopted when the network is supplied by a number of grid points, each with two transformers, is illustrated in Fig. 2a for the case of a network supplied by three such grid points. Each busbar section at the three supply points would have connected to it one grid transformer, a load P_1, which might be radial feeders or local 33 kV/h.v. transformers, and one or more 33 kV circuits to one section of an adjacent grid substation. These interconnecting circuits would supply loads P on route whose maximum value could be equal to the ratings of the associated circuits. With all equipment in service, the 33 kV bus section breakers at the grid points would be open.

This application of the meshed network dispersed infeed method of supply would permit very good use to be made of the transformer capacity provided. In fact, it would be possible to supply a load equal to 75 per cent of the total nominal transformer capacity or even, under the best conditions, to approach 75 per cent of the total transformer capability. These figures result from the pooling of capacity of adjacent load groups which would result from closing a 33 kV bus section circuit-breaker. For instance, if transformer TB1 (Fig. 2a) should trip, the loads, P, P, P_1 and P_1 would continue to be supplied by transformer TA2 with loads P, P and P_1 flowing over the two circuits out of substation A. By closing section breaker S, three transformers would be paralleled on to two load groups (Fig. 2b), and the ratio of the impedances of the transformers to the interconnecting 33 kV circuits would usually be such that the three transformers would share load well. With facilities for rapid control at selected points of the 33 kV network (e.g. supervisory control or manning of the grid points), the considerable overloads on one transformer and part of the 33 kV network which might occur between the tripping of a transformer and the closing of the bus section circuit-breaker at the associated grid point, would be acceptable.

The load density will determine the size of grid transformers and the spacing of grid points on a network. 30 MVA and 45 MVA transformers are used more frequently than any other sizes nowadays* and with these capacities it would usually only be possible to parallel three, or occasionally four transformers on to one section

TABLE I

Grid Point	Transformer Allocation to Network			
	Section 1 (includes large consumer)	Section 2	Section 3	Section 4
A (3 transformers) ...	2	1		
B (2 transformers) ...		1	1	
C (2 transformers) ...			1	1
D (2 transformers) ...				2
E (1 transformer) ...			1	

of the 33 kV network without exceeding the commonly accepted maximum 33 kV fault level of 750 MVA. Two 60 MVA transformers would give a 33 kV fault level of about 700 MVA, and if, for instance, a scheme similar to that outlined in Fig. 2a were to be adopted, using 60 MVA transformers, it would probably be necessary to make provision for increased impedance in the transformer circuits (say, 16 per cent instead of the usual 12·5 per cent) to permit the paralleling of three transformers when necessary. The fault level with dispersed infeeds would be lower than if the same transformer capacity were concentrated at one point, but on a cable network at the 33 kV voltage level the reduction would only be slight.

* Central Electricity Authority Annual Report and Accounts, 1956–57.

There are obviously numerous ways in which sections of network supplied by three transformers can be formed. For instance, in one case which has been investigated, an area of about 80 square miles would be supplied by five grid points A, B, C, D and E with three, two, two, two and one grid transformers, respectively, grid point A supplying a large consumer very near to the substation. A suitable scheme was to split the 33 kV network in that area into four sections, two being supplied by three transformers, as indicated in Table I.

As the load increased and more transformer capacity was provided, the transformer groupings would be altered by increasing the capacity of sections supplied from two transformers by the addition of a third transformer and also by increasing the number of sections into which the network was divided.

A certain minimum 33 kV circuit capacity would have to be made available between each of the grid transformers supplying a section of network for use when any transformer was out of commission. If an alternative could be made available quickly, say as in Figs. 2a and 2b, it would be possible to make use of the short-time overload capacity of the 33 kV circuits to provide this reserve interconnection. If, on the other hand, no alternative supply was readily available, it would be necessary for part of the interconnecting circuit capacity to be reserved for this purpose.

TABLE II

Number of transformers and size (MVA) per section of network	Minimum interconnection between transformers at adjacent grid points	Approx. maximum loading P per interconnector MVA	Approx. maximum loading $2P_1$ per grid substation busbar MVA	Approx. maximum section loading MVA
2×45	2×0·2 sq. in cables	15	2×15	60–70
2×60	2×0·3 sq. in cables	20	2×20	80–95
3×45	1×0·3 sq. in cables	15	10	75–110
3×60	2×0·2 sq. in cables	12	12	110–140

Some suggested minimum circuit capacities between adjacent grid transformers and the associated circuit loadings are given in Table II. The first two cases assume that with a transformer out of commission, two sections of network would be paralleled by closing the section breaker at the appropriate grid point. The third and fourth cases assume single-transformer grid points.

In columns 3 and 4, lines 3 and 4, the distribution of load between the interconnectors and the grid substation busbar sections could differ from those given, provided the total load per interconnector with a transformer out of commission did not exceed the rating of the interconnector.

In the fifth column of the table, giving approximate maximum section loading, the lower figure is in each case a limit set by the suggested minimum 33 kV network. If more than this capacity existed, the overload capability of the transformers would determine the maximum loading per section of the network, as suggested by the higher figures.

Comparison of Methods

Comparisons of the meshed network with other methods of development can be made in respect of operation, maintenance, security of supply, construction and future development and cost.

Operation Maintenance and Security of Supply.—One of the difficulties attendant on any scheme in which two networks at widely differing voltages are operated in parallel, is that some changes in the higher-voltage system, in particular loss of that part of this network paralleled by the lower-voltage network, may throw a heavy through transfer on the lower-voltage network.

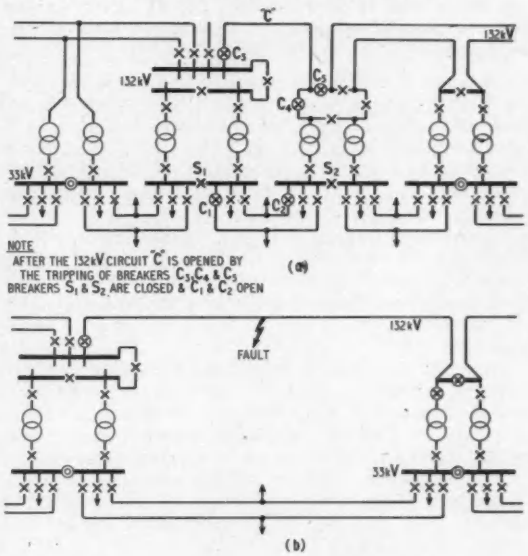
In this instance, the 33 kV network could be safeguarded in various ways against excessive power flow following the tripping of a 132 kV circuit. First, the maximum benefits from the method would follow if the system were supervisory controlled. If conditions occurred on the 132 kV network which threw a heavy through transfer on the 33 kV network, it would be permissible to open by supervisory control one end of the 33 kV interconnectors carrying the through transfers, as the chance of a fault on these interconnectors during the limited periods of 132 kV line outage would be small, and even if such a fault did occur, closing the previously opened end would restore supply. At the same time, the 33 kV section breakers at the adjacent substations would be closed (Fig. 3a). Secondly, directional overcurrent relays on the grid transformers could be used to limit through transfers to a low value. Thirdly, heavy through transfers could be prevented by the appropriate setting of an overcurrent relay at the load centre of each of the interconnectors. However, in view of the necessity to set any protective relays at values sufficient to carry safely the maximum overloads proposed, any schemes using protective gear would be likely to permit small through flows to occur which, in view of the normal circuit loadings suggested, would be liable to cause damage if they were not interrupted.

Sometimes the primary circuit arrangements themselves would prevent through flows. When the tripping of the 132 kV circuit also tripped the grid transformer, as in a three-switch substation (Fig. 3b) the 33 kV parallel branch would be protected automatically from through transfers immediately following the fault.

In normal operation, as a maximum, some 5 per cent of the through transfer between two substations would

Fig. 3a.—Switching on the 33 kV network with a paralleling 132 kV circuit out of commission

Fig. 3b.—Automatic interruption of 33 kV parallel path when a 132 kV three-switch substation is used



flow in the 33 kV interconnecting circuits. This is unlikely to be important, permitting as it would a three-to-one ratio of power flow into the two ends of each interconnecting circuit with equal co-phasal voltages at the infeeding busbars. Outage of plant, in particular the 132 kV circuits, for maintenance would require co-ordination between the staffs controlling the 132 kV and 33 kV networks.

It seems, therefore, that whilst the mutual interaction of the 132 kV and 33 kV networks could affect 33 kV circuit loading, this would not be important under normal conditions and could be guarded against in emergency by the provision of adequate (probably supervisory) control facilities.

In other respects, the operational advantages would lie with the meshed network dispersed infeed method. Better security from faults, human errors and natural mishaps would result from supplying a section of network from two or more independent points. The grid transformer capacity provided would be better used as each transformer would then help to reduce the 33 kV network losses and serve to maintain a uniform voltage level, in addition to providing standby capacity to the other transformers.

When necessary, adjacent sections would be paralleled at their electrically strongest point, the bus section circuit-breaker, and not at their weakest point, mid-way between two sections, as happens in other methods of development. In this connection, it should be noted that while paralleling of sections might not be possible if more than two transformers per section were used, the extra facilities of double busbar switchgear, where it had already been provided at existing grid points, would give practically equal facilities in that it would then be possible to transfer load between sections at these double busbar substations.

Construction.—The initial establishment of the system would probably involve a considerable amount of circuit rearrangement at the existing grid substations. With this work done, however, future reinforcement and addition of grid points would be easy and would involve no major rearrangements of the 33 kV network (Fig. 4).

Co-ordination of the planning of the 132 kV and 33 kV networks would be even more important than usual where it was proposed to use this method. Provided that at least one direct (that is not reactored) 132 kV circuit existed between the grid substations supplying one section however the meshed network method could be used.

Costs and Future Development.—The cost of applying the meshed network method would depend on what 33 kV network already existed. A well-developed network, such as is sometimes found supplying the larger cities, could frequently be modified to meshed network operation fairly easily as adequate 33 kV interconnecting circuits and switchgear would exist between grid points.

Generally, it is considered that reinforcement, by the installation of new grid points, of a network already operated and developed in the meshed network way, would be cheaper than reinforcement of a network supplying the same load, but operated and developed by other methods.

However, the establishment from nothing of a 33 kV network capable of meshed work operation might cost more than the establishment of, say, an equivalent system of transformer feeders. The increased switchgear costs might, or might not, be balanced by possible savings in 33 kV circuit construction, the relative costs of which would depend entirely on the geographical disposition of the grid and load points. As already mentioned, the making firm of a 33 kV circuit by routing it between two grid points would give a better ratio of possible connected load per mile of circuit constructed than would the duplication of circuits to give a firm supply.

A compromise between a reduction of initial expenditure and the obtaining ultimately of a connection between grid points is effected by one Board by the initial use of transformer feeders. A 33 kV/h.v. substation is established with one transformer and with standby from the h.v. network. Space is provided at this substation for the provision of one or two 33 kV ring main units in the future.

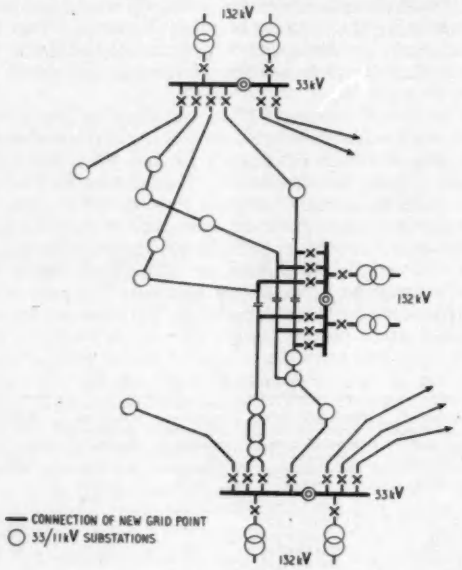


Fig. 4.—Reinforcement of a group by the interposition of a new grid point

As the load increases and further 33 kV/h.v. substations are required, the circuit is extended through these substations to the next grid point, 33 kV switchgear (usually ring main units) being provided at the load points.

Conclusions

The supplying of a section of 33 kV network by two or more grid transformers located at different points and paralleled by the 33 kV network has been advocated on the grounds that:

(1) The grid transformer utilisation would be high.

(2) It would permit an economic development of the 33 kV network.

(3) Lower losses and improved voltage conditions on the 33 kV network would result.

(4) Better security of supply would be obtained.

It is anticipated that this method will be put into operation during the next few years in several regions of one Area Board and, in fact, 33 kV networks supplying city, suburban and rural areas are now being planned in this way. It is hoped that operational experience will then justify the claims made above.

Acknowledgment

The author makes acknowledgment to Mr. P. d'E. Stowell, chief engineer of the Merseyside and North Wales Electricity Board, who has long been an advocate of meshed network development, for helpful interest and permission to publish this article.

ELECTRICITY AND WORLD PROGRESS

BRITAIN'S CONTRIBUTION

The title of these notes is the theme of this year's British Electrical Power Convention to be held at Brighton next week. Sir George Nelson, Bt., LL.D., F.C.G.I., D.I.C., Past-president, I.Mech.E., Past-president, I.E.E., is the President of the Convention and the Vice-President is Mr. C. R. King, C.B.E., Companion I.E.E., M.Inst.F. The Convention Council is composed of representatives of the electricity supply authorities, professional bodies and manufacturers', wholesalers' and contractors' organisations. All the business meetings, including the presentation and discussion of five papers and the "Electrical Forum" and annual general meeting, are taking place in the Dome. The exhibition, details of which are given in subsequent pages, is at the West Street Car Park. Details of the programme are given below.

The B.E.P.C. Programme

MONDAY, 16th JUNE

9 p.m. Opening of Exhibition by the President.

TUESDAY, 17th JUNE

10 a.m. Opening of Convention, civic welcome and presidential address.

12.30 p.m. E.A.W. luncheon at the Hotel Metropole.

1 p.m. Rotary Club luncheon at the Old Ship Hotel.

2.45 p.m. Paper, "The Development of Nuclear Energy for Electricity Supply in Great Britain," by Sir Christopher Hinton, K.B.E., F.R.S. (chairman, Central Electricity Generating Board).

3.30 p.m. Ladies' tea at the Aquarium Restaurant.

8 p.m. Reception by the Mayor and Mayoress of Brighton (Councillor and Mrs. A. J. Sadler) in the Corn Exchange, followed by a dance.

WEDNESDAY, 18th JUNE

9.30 a.m. Paper, "The Development of Nuclear Energy for Electricity Supply Overseas," by Sir Claude Gibb (chairman, C. A. Parsons & Co., Ltd.); presented on behalf of the B.E.A.M.A.

2.45 p.m. Paper, "Britain's Part in Electrical Development Overseas," by Mr. H. J. Beard, B.A., M.I.E.E. (Merz & McLellan); presented on behalf of the Association of Consulting Engineers.

THURSDAY, 19th JUNE

9.30 a.m. Paper, "British Hydro-Electric Plant and World Power Requirements," by Messrs. J. C. Beverley, M.A., A.M.I.Mech.E., A.M.I.E.E., E. G. Teasdale, B.A., and A. Wilmot, B.Sc.Tech., D.I.C., A.M.I.Mech.E. (English Electric Co., Ltd.); presented on behalf of the B.E.A.M.A.

2.45 p.m. Paper, "The Development of the Electrically Equipped Kitchen," by Mr. J. I. Bernard, B.Sc.Tech., M.I.E.E., M.I.H.V.E. (director and secretary, British Electrical Development Association).

7 for 7.30 p.m. Annual dinner at the Corn Exchange.

10.30 p.m. Cabaret and dance at the Dome and Corn Exchange.

FRIDAY, 20th JUNE

10 a.m. Electrical Forum. The panel at the Forum will consist of Mr. A. R. Cooper, M.Eng., M.I.E.E. (regional director, Eastern, London & South Eastern Region, C.E.G.B.), Sir Claude Gibb, Sir John Hacking, M.I.E.E. (Merz & McLellan), Sir Christopher Hinton, Mr. A. N. Irens (chairman, South Western Electricity Board) and Mr. W. H. McFadzean, C.A., Companion I.E.E. (chairman and managing director of British Insulated Callender's Cables, Ltd.).

12 noon. Annual general meeting.

During the week golf competitions for men and women will be held at the East Brighton Golf Course. The proceeds will be given to the E.I.B.A.

1. *The Dome* **2.** *Corn Exchange* **3.** *Electrical Exhibition* **4.** *Grand Hotel* **5.** *Metropole Hotel* **6.** *Old Ship Hotel* **7.** *Aquarium Restaurant*

Aerofilms

Convention Exhibition

PREVIEW OF THE BRIGHTON DISPLAY

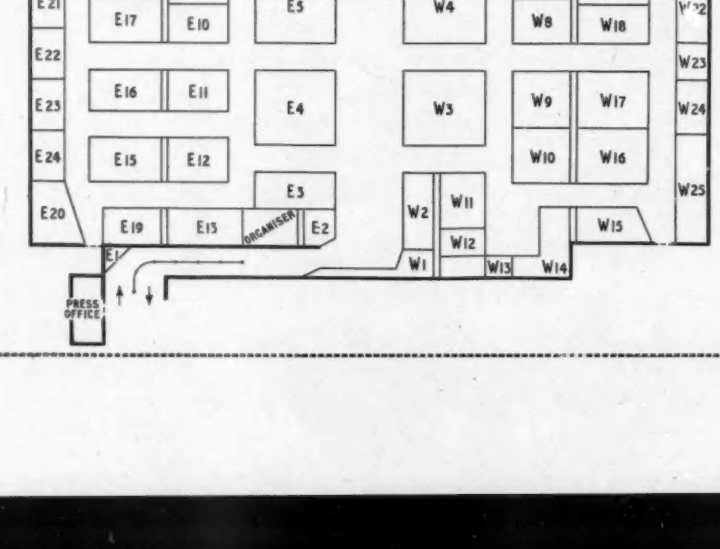
ALTHOUGH delegates and visitors to the tenth British Electrical Power Convention at Brighton this year will find that the exhibition is smaller than in previous years, there is no falling off in the standard of the displays and both the light and heavy sides of the electrical industry will be well represented. The accent, if any, is on domestic electrical appliances and several items will be on view for the first time. The exhibition, arranged in conjunction with the Convention and organised by the British Electrical Development Association, will be held in a tented building situated in the West Street car park. Over 50 exhibitors will be taking part, including eight non-manufacturing organisations. An illuminated indicator board providing a quick and easy guide to the various stands will again be provided at the entrance by the *Electrical Review* for the convenience of visitors.

The official opening will be by the President, Sir George Nelson, at 9 p.m. on Monday, 16th June. The exhibition will, however, be open to delegates from 10 a.m. on that day. On Tuesday admission will again be restricted to delegates and ticket holders, and the closing time will be 6 p.m. The public will be admitted, free of charge, on the remaining days, the hours of opening being from 10 a.m. to 9 p.m. on Wednesday and Thursday, and from 10 a.m.

LIST OF EXHIBITORS

A.E.I. LAMP & LIGHTING CO., LTD., Crown House, Aldwych, London, W.C.2 ... ... E.9
AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Greenford, Middlesex E.17
ATLAS LIGHTING, LTD., 233, Shaftesbury Avenue, London, W.C.2 ... W.10
BACKER ELECTRIC CO., LTD., Fitzwilliam Road, Rotherham, Yorkshire W.20
BELLING & CO., LTD., Bridge Works, Enfield, Middlesex E.7
BRITISH INSULATED CALLENDER'S CABLES, LTD., Prescot, Lancs ... W.16
BRITISH LIGHTING COUNCIL, 2, Savoy Hill, London, W.C.2 ... ... E.19
BULPITT & SONS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18 ... ... W.7
BURCO, LTD., Waterside Mill, Rose Grove, Burnley, Lancs E.3
CENTRAL ELECTRICITY GENERATING BOARD, Winsley Street, London, W.1 ... ... E.6
COLE, E. K., LTD., Ekco Works, Southend-on-Sea, Essex E.12
DIMPLEX, LTD., Millbrook, Southampton W.6
EASICLENE PORCELAIN ENAMEL (1938), LTD., Darlaston, South Staffs E.20
ELECTRICAL ASSOCIATION FOR WOMEN, 25, Fouberts Place, London, W.1 ... ... E.2
ELECTRICAL INDUSTRIES BENEVOLENT ASSOCIATION, 10, Buckingham Palace Gardens, London, S.W.1 ... E.1
ELECTRICAL JOURNAL, Bouverie House, 154, Fleet Street, London, E.C.4 ... ... W.23
ELECTRIX, LTD., Sterling Works, Dagenham, Essex E.14
ELECTROLUX, LTD., 153-155, Regent Street, London, W.1 ... ... E.15
ENGLISH ELECTRIC CO., LTD., Queens House, Kingsway, London, W.C.2 ... ... W.4
FERRANTI, LTD., Hollinwood, Lancs E.16
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2 ... ... W.3
HALL & PICKLES, LTD., P.O. Box 116, Manchester, 1 ... ... E.21
HEATRAE, LTD., Heatrae Works, Norwich, Norfolk W.11
HENLEY'S, W. T., TELEGRAPH WORKS CO., LTD., 51-53, Hatton Garden, London, E.C.1 ... ... W.14
HOOVER, LTD., Perivale, Greenford, Middlesex W.19
HORSTMANN GEAR CO., LTD., Newbridge Works, Bath, Somerset ... E.23
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2 ... ... E.10
JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1 E.5
JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7 ... ... W.8
MACLAREN, ROBERT, & CO., LTD., Eglinton Works, Kilbirnie Street, Glasgow, C.5 ... ... W.22
MAIN, R. & A., LTD., 48, Grosvenor Gardens, London, S.W.1 ... ... E.8
M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, London, N.18... E.11
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1 ... W.25
NATIONAL INSPECTION COUNCIL FOR ELECTRICAL INSTALLATION CONTRACTING, 13, Victoria Street, London, S.W.1 ... ... W.13
PANELEC (GREAT BRITAIN), LTD., 21, Bloomsbury Street, London, W.C.1 W.5
PARNALL (YATE), LTD., 255, North Circular Road, Neasden, London, N.W.10 ... ... W.17
REVO ELECTRIC CO., LTD., TIPTON, Staffs E.26
REYROLLE, A., & CO., LTD., Hebburn, Co. Durham W.2
SANGAMO WESTON, LTD., Enfield, Middlesex E.18
SANTON, LTD., Somerton Works, Corporation Road, Newport, Mon ... W.18
SIEMENS EDISON SWAN, LTD., 38/39, Upper Thames Street, London, E.C.4 ... ... E.24
SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs ... E.4
SOUTH EASTERN ELECTRICITY BOARD, Hove, 3, Sussex W.1
SOUTH WALES SWITCHGEAR, LTD., Blackwood, Mon W.21
TATE BROS., LTD., 100, Old Shoreham Road, Portslade, Sussex ... E.25
TETRA ENGINEERING CO., LTD., 1-3, Redhill Street, London, N.W.1 ... E.22
TRICITY COOKERS, LTD., 109, Kingsway, London, W.C.2 ... ... W.9
VACTRIC, LTD., 196, Sloane Street, London, S.W.1 ... ... E.13
WANDLESIDE CABLE WORKS, LTD., 106, Garratt Lane, Wandsworth, London, S.W.18 ... ... W.24
WILKINS & MITCHELL, LTD., Darlaston, Staffs W.15

PLAN OF THE EXHIBITION



to 1 p.m. on Friday. The exhibition will be closed daily from 1 p.m. to 2.30 p.m.

The English Electric Co., Ltd., will be showing new 6½ and 8in radiant type "Vee-line" hotplates. These plates derive their name from the distinctive shape of their tubular element, which is that of an inverted triangle, and are claimed to give maximum contact between plate and pan. They comply with the E.D.A./B.E.A.M.A. standards of interchangeability and the respective loadings are 1,250 W and 2,100 W. The element of each plate is sheathed in "Inconel" to withstand any corrosive effect of spillage, and because of the wide angle through which the element may be lifted from its stainless steel rest the aluminium reflector can easily be removed for cleaning. Among the company's refrigerators which will be represented will be a family sized 8·4 cu ft model with full-width evaporator and door shelves, and the "Slim-line" table top model, introduced earlier this season. Designed for the smaller kitchen, this refrigerator, model 7503, will fit into a space of only 20in between other appliances and units. Three full-width removable rod shelves are fitted and on the inner panel of the door there is provision for six eggs, a shelf for small packets, a full-width dairy-keeper and storage space for four large bottles. The finish is in white or cream with a paradise blue interior relieved with touches of kingfisher blue and bronze.

The latest electric cookers in the company's range will include two automatic types. Model 2031 has an extra large oven with interior light as standard fitting and the raised oven cooker, with three-plate hob below, will be shown with a glass oven port. Home laundry equipment will be represented by the model 4005 washing machine with stowaway power wringer, heating element and automatic pump.

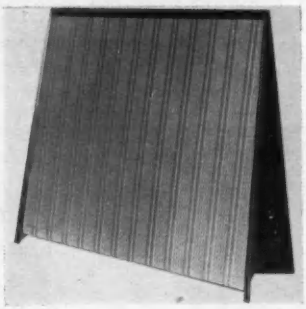
A full range of "Creda" domestic electrical equipment will be seen on the Simplex Electric Co.'s stand, including manual and timer-controlled cookers, space heaters in a variety of colours, storage type and immersion heaters, and the "Debonair" spin dryer. Cookers will be represented by the "Carefree" and "Stargazer" models. The "Carefree," as its name implies, is a timer-controlled cooker and will be displayed in its standard form and as a glass door model, both types having a roomy warming drawer. The "Stargazer" will also be shown in two styles, one as a de-luxe model with timer-control and storage drawer and the other as a standard plinth type with manual control. Both incorporate the "Creda" glass door-within-a-door feature.

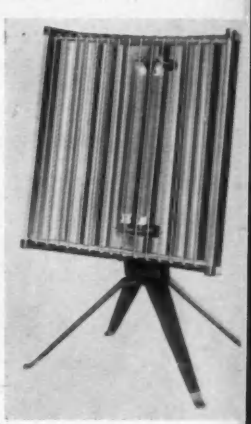
"Creda" heating appliances on display will include the "California" 1½ kW panel heater, the "Capri" 1 kW portable heater, and 750 W and 2 kW models of the "Calypso" convector heater. Also shown will be the "Cubana" radiant fire, produced in 1 and 2 kW sizes. All the heating appliances are finished in a selection of six two-tone colour schemes, among which should be found a colour to complement any room design. The company's "Debonair" spin dryer will also be prominently shown in standard white and cream, blue, green and turquoise.

The company's water heating appliances will include the thermostatically controlled 3 gal "Crusader," while the well-established "Redhead" immersion heaters will be presented in an improved and modified form. The new model has a reduced height terminal cover measuring only 1¼in, an advantage when fitting it into a confined space. Two types are available in a selection of lengths, one with a pocket suitable for rod type thermostats and the other with a pocket suitable for the Sunvic "TQB" thermostat. Storage water heaters are represented by a 5 gal cistern type, 5 and 12 gal pressure types and the 20 gal "Centrepoint," a completely self-contained floor-mounting model.

"Creda Centrepoint" 20 gal floor mounting water heater (Simplex Electric Co., Ltd.)

English Electric "Slim-line" refrigerator



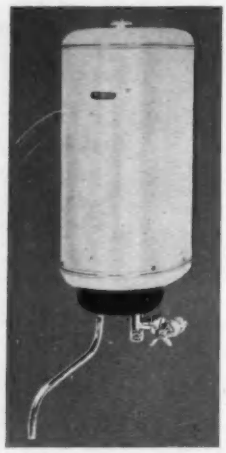


Two of the new G.E.C. heaters: the "Cosyvec" convector heater (left) and multi-faceted "Cosyglo" reflector fire

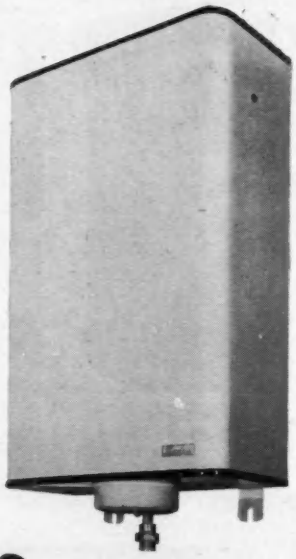
Apart from domestic exhibits, Simplex will be showing a varied range of lighting fittings which will include new types of 60 and 100 W wall-mounted screwglass fittings, with a choice of four colours for matching or contrasting reflectors and wall brackets. Anti-corrosive fluorescent fittings and "Corrilux" bulkhead fittings will also be shown as well as "Arvit" (acid-resistant vitreous enamel) industrial reflectors. In the Simplex ironclad accessories range will be a 12-gang switch, which has been accepted by the Council of Industrial Design for its "Design Index."

A special attraction at the General Electric Co.'s stand will be five heating appliances shown for the first time. They comprise a portable or wall mounting steel cased fan heater, a "Cosyrad" panel heater, a "Cosyvec" convector heater, a new "Cosyglo" reflector fire, and a 1 kW reflector fire with a visor guard. Other exhibits include the "Supreme" and "Quality" cookers, "Superspeed" boiling plates, 6 and 8 cu ft refrigerators, "Superspeed" kettles, irons, coffee percolators and hair dryers and the company's latest cylindrical cleaner.

The new fan heater, resiliently mounted on a black Bakelite handle frame, has back and front covers of pressed steel providing the air inlet and exhaust. Its two 1 kW separately switched elements operate at black heat and to ensure safety in use an automatic thermal cut-out is incorporated. The fan of the heater is operated by a



Heatrae "Lido" water heater



Santon wall mounting cistern type water heater

In this view of the Hoover "Hoovermatic" the tub of the washing machine can be seen on the left and the spin dryer on the right. In the foreground is the timer dial and the emptying hose is at the top of the picture

silent induction motor which has a consumption of only 28 W.

Providing an adequate proportion of radiant and convected heat, the "Cosyrad" thermostatically controlled panel heater is designed to give even temperature room heating with maximum comfort in front of the heater. Two 750 W sheathed wire elements operate at black heat and a pilot light indicates when the heater is on. If desired, the heater can be wall mounted, brackets being supplied as an optional extra. It measures 25in high by 27in wide and the depth with legs and handles is 6½in. The "Cosyvec" convector is designed in a trianguloid shape and has an unusually high proportion of heat radiated forward at a low angle to provide extra comfort at floor level. Its slender lines and black and gold colouring enable it to tone in with all types of furniture, while its all metal construction with "expandmat" grill ensures long life. The loading is 2 kW, thermostatically controlled, and a pilot light is fitted.

The latest addition to the "Cosyglo" range of fires has an improved multi-parabola reflector, designed on optical principles, which ensures distributed warmth, with slightly more heat to the sides than directly in front. Apart from the heating efficiency of this form of reflector there is a cheering all-round glow of warmth from the reflection of the elements. The finish is in burgundy and black and the fire is fitted with a visor guard which automatically drops into position and can be readily raised for easy cleaning of the reflector by the simple release of a spring catch. Also fitted with a visor guard is the model D2776 1 kW portable fire. Finished in burgundy with black legs it stands 14½in high by 15½in wide by 8½in deep.

Prominent among the Hoover exhibits will be the "Hoovermatic" combined washing machine and spin dryer. This machine, the company's newest product, spin dries while washing and is claimed to be able to deal with an average family wash of four 6 lb loads in 30 minutes at an average time of under 8 minutes per load. An automatic pump is fitted for emptying purposes and models are now available with or without a heater. The company's Mark II (hand wringer) and Mark III (power wringer) washing machines are also shown.

The range of vacuum cleaners will include the "Constellation" spherical model and two versions of the "Dustette" hand cleaner, one with a handy carrying strap and a full range of tools and the other with a nozzle brush only. The company's steam-or-dry iron will also be shown and the display is completed by exhibits of f.h.p. motors.

A washing machine hitherto seen only in Scotland and the north of England will be displayed on the Hotpoint Electric Appliance Co.'s stand. It is the "Plus Six Countess" model, small enough to store under a draining board yet with a power wringer high enough to swing over a sink. The self-indicating controls, for heat, motor, wash and pump respectively, are at a convenient height to obviate stooping. It is finished in stove-enamelled white or cream, with vitreous-enamelled bowl; heated (2 kW) and unheated models are obtainable. The "Empress" and the "Princess" washing machines will also be shown.

Among refrigerators will be the C.36 (3·6 cu ft) and C.50 (5 cu ft) models, both available either as build-in models without table top, or with table tops in white, cream, red, blue or green. Space heating appliances will include the Hotpoint convector, available with thermostatic control, and the neat contemporary styled "Hystan" fire mounted on slender, ball-ended legs. An interesting feature of a range of smaller products will be the 3 pt "Pylon" electric kettle, now fitted with a 2 kW "Torribar" sheathed wire element. This incorporates a safety device which operates with a short "on" and long "off" period if the kettle should be switched on while empty and which at once restores the circuit when the kettle is filled. Immersion heaters include the "Twimerser," with its shorter element for the sink and longer element for heating 15 gal of bath water in an hour, while 1½ and 5 gal storage heaters will represent a range of from 1½ to 30 gal which includes cistern types.

A completely new design of rectangular wall mounting cistern type water heater, available in capacities of 5, 7½, 12, 15 and 20 gal, will be on view on the stand of Santon, Ltd. The units incorporate their own ball valve tank and are suitable for connecting direct to town's water mains and for supplying water to two or more points. Apart from domestic applications, the heaters are suitable for industrial use. The finish is in white enamel, with black top and base, and as they are of contemporary shape and design, they will fit into almost any decorative scheme. All models are completely automatic.

On the Heatrae stand the accent will be on domestic applications of electric water heating and space heating. It will be designed to indicate, in a colourful way, the

various sections of the modern home and the type of heating equipment which will give the most satisfactory service, and emphasis will be placed on the company's range of "Lido" sink water heaters.

The Dimplex display will include permanently oil-filled thermostatically-controlled electric radiators in loadings of ½ to 3 kW; domestic infra-red heaters; permanently oil-filled electric towel rails; skirting board styled convectors; airing cupboard and general purpose heaters; and overhead radiant heaters. One of the company's latest lines is the 750 W domestic infra-red heater. Primarily designed for the bathroom or kitchen, it incorporates a parabolic reflector of anodised aluminium and a pressed steel base plate finished in various stove-enamelled colours. The die-cast aluminium end caps are finished in black stove enamel to contrast. The spiral element is supplied in a silica sleeve, fully wired up and *in situ*, thus involving the minimum of installation. Included among the oil-filled electric towel rails on view will be the "Major," available in loadings of 150 and 200 W, which can be supplied for wall mounting only, wall and floor mounting, and floor fixing only. The "Minor," in 90 and 120 W sizes, is designed for the smaller bathroom or can be fitted on to the end of a standard kitchen sink unit. Finish of both types is in chromium or high gloss stove enamel, with a choice of eight colours.

The overhead type radiant heaters are now in full production by the company and available in loadings of 2½ and 4 kW. They incorporate "Inconel" elements and are ruggedly made for heavy duty in commercial and industrial installations. The Dimplex skirting board styled convectors, now being sold in the United States and Canada as baseboard heaters, are displayed in various lengths. These heaters can be built up in multiples or be used separately as free standing portables with feet. Two models are available in 2ft and 3ft lengths, loadings being 300 and 500 W respectively.

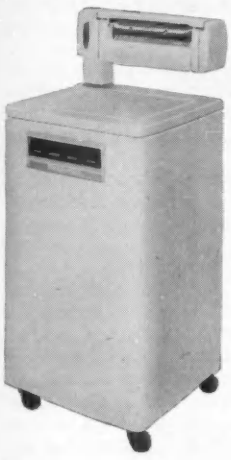
The greatly extended range of "Ekco" electric heating equipment, including new radiant fires and electric blankets, will be displayed by E. K. Cole, Ltd. Designed for the popular market, the "Victor" range of radiant fires is available in loadings of 1,000, 1,000/2,000, and 1,250/2,500 W. Attractively styled, with the die-cast frame in cream, they include pencil-slim elements, element supports of monel metal and scientifically constructed reflectors. A realistic flame effect is incorporated in the "Flamera 20" decorative fire. Independent switches control the two 1 kW elements, enabling the coal unit to remain illuminated while the elements are "off." Also to be seen is an attractive 2 kW panel fire designed for easy installation, being mounted directly on to the wall without recessing. Suitable for installation in almost any location, is the "Firestreak" wall fire which incorporates an adjustable reflector, enabling the glow from the silica glass sheathed element to be directed as required. Interchangeable end caps are available in a choice of eight colours, to blend with any decorative scheme. The loading is 750 W. For industrial use there is the "Twinstreak" overhead suspension heating unit. Suspension is by conduit or chain and the loading is 1,500 W.

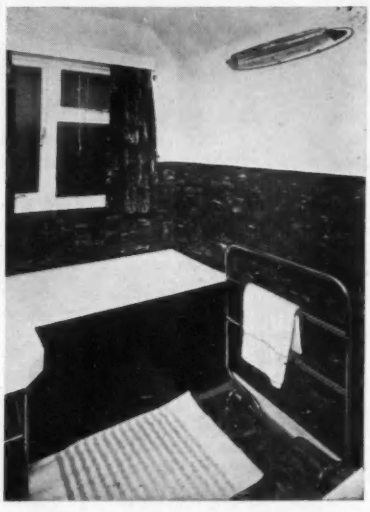
Electric blankets have recently been added to the Ekco range of products and several models are to be shown. Among these will be the "Popular," "De-Luxe" and "Vigilux" series, all of which are fireproofed and incorporate a waterproof and acidproof element, making them suitable for home laundering. The well-known "Ekco Thermovent" range of convector heaters will also be displayed, including the recently introduced type "K" model (2 kW) and the popular "FR" range in 1 or 2 kW sizes. Among other "Thermovent" heating equipment on show will be high-temperature "Thermopanels"; unit heaters; standard, flameproof and horticultural "Thermotubes"; thermostats; and a working example of a drying cabinet heater.

Convector heaters and radiant electric fires will also be among the products to be shown by Morphy-Richards, Ltd. Apart from these, the company will display a representative range of appliances including irons, toasters, hair dryers, door-chimes, refrigerators, etc. Special demonstrations are to be arranged of the "Super-Suction" spherical type vacuum cleaner during the period of the exhibition. The machine is claimed to have the most powerful motor to be used in a domestic cleaner (1 h.p.), but for light work, such as curtains, etc., the power can be readily reduced by twisting the suction control. A rubber-wheeled trolley, specially designed for the cleaner, is now available. Also to be the subject of daily demonstrations will be the Morphy-Richards "Astral" cabinet type spin dryer, which is claimed to be able to prepare 30 lb of wet clothes ready for ironing in approximately two minutes.

Electric cookers will form the main display on the stand

Hotpoint "Plus Six Countess" washing machine

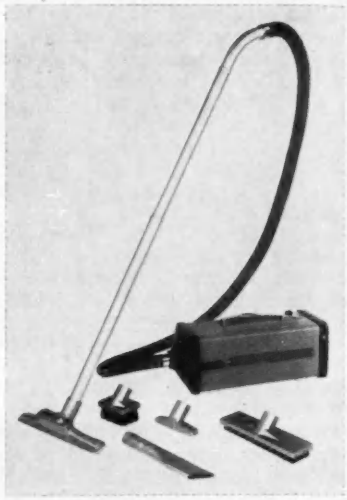




Above: "Flamera" decorative fire (E. K. Cole, Ltd.). Right: Dimplex domestic infra-red heater and "Major" towel rail shown in a typical bathroom setting

Jackson "Joy" model 396J electric cooker

Electrolux model L76 7·6 cu ft refrigerator



Electrix "Square Line" vacuum cleaner

Belling model 52 "Baby" cooker

Tricity "Popular" electric cooker

of Belling & Co., Ltd., where a full range will be on view. Among these will be two new "Baby" cookers, models 52 and 51H, and a large horizontal cooker, model 47H. The company will also be displaying several electric fires in new coloured finishes which will be available for next season, as well as a plate and dish warming cabinet, and a drying cabinet.

Since last year's Convention exhibition several new products have been added to the Revo Electric Co.'s range, the latest of which is the "Roto-Iron," a portable rotary table ironer. The ironer, which will be on show on the company's stand, will accommodate almost every type of laundered article. The roller measures 21in in length by 5¼in diameter and being thermostatically controlled can be set to the correct heat to deal with any particular fabric. The heater loading is 1,250 W and the motor 70 W, thus enabling the ironer to be used from any 5 A outlet. The weight is 28½ lb and it is finished in either cream or white enamel and chromium. A number of new-styled desk and ceiling fans, in a number of gay colours, will also be presented on this stand. The desk fans can also be adapted for wall mounting and are supplied with ash grey body and blades in a choice of five colours, whilst the bodies of the ceiling fans are moulded plastic spherical castings and ceiling cup in a range of colours, with contrasting blades. Other Revo items on display will include the now well-known timer-controlled "Revomatic" cooker, the "Regent" cooker with "easy-view" glass door and option of timer control, and the space-saving "Peerless Major" cooker which incorporates a built-in kitchen cabinet. A recently introduced range of electric fires and convector heaters will also be shown, together with irons, kettles, plate warmer, etc.

Refrigerators, vacuum cleaners and floor polishers will form the major part of the Electrolux display. Although no actual new products will be shown, prominence will be given to their wide range of absorption type refrigerators, in sizes from 1·7 cu ft to 7·6 cu ft and to their models 60 and 62 cleaners. A cleaner of new design will be shown on the stand of Electrix, Ltd. It is rectangular in shape, with square moulded end caps, and will be known as the "Square Line," but further details are not at present available. Two new smaller vacuum cleaners (both 250 W) will also be shown in addition to the larger "Silent Electrix" and "Nu-Electrix" models. Another new Electrix appliance to be seen is a drying and airing cabinet. Measuring 35in high by 20in wide by 15in deep, it has a capacity equal to 18ft of clothes line. It is provided with triple-heat control (500, 750 and 1,250 W maximum) and apart from clothes can also be used for drying dishes, etc. The finish is in white or cream and the weight is 50 lb.

Cylinder (W.303) and upright (R.58) cleaners will be shown by Vactric, Ltd., in addition to a floor polisher and scrubber. The company will also have on view their washing machine, claimed to be revolutionary in as much as it employs moulded polyester glass fibre in its tub construction. In this way a large tub is incorporated in a moderately-sized machine. It is a fully heated model (two 1,500 W elements) and a pump and powered wringer are fitted.

One of the latest products of Parnall (Yate), Ltd., is the "Thor Automagic" model 260 "Spin-dry" clothes washer. This machine, which will be seen on the Parnall stand, has a dry clothes capacity of 8 lb, and washes, rinses and spin dries in one continuous operation, all in one tub. Three foot pedals start and stop the agitator and the spin dryer, leaving the hands free. The clothes tub is vitreous enamelled inside and out and a ¼in armourplate glass lid is fitted. Also prominently featured will

be the models EW.51 and EW.51H washing machines and the "Auto-Dry" tumbler dryer. On the refrigeration side the company will show the "Alaska" model 102 2·4 cu ft and model 101 3·3 cu ft refrigerators.

The latest "Servis," "Superheat" and "De-Luxe" washing machines to be exhibited by Wilkins & Mitchell, Ltd., will embody the new "Taperline" styling with a full-length door. Operation of the washer has been made even simpler. The only control which previously was not situated on the exterior of the machine (the pump switch) is now found at waist level on the top of the machine, complementary to the master control for motor, washing action and electricity supply. The pump itself has been redesigned so as to empty through the pump hose which is introduced into an outlet in the tub itself and then laid over the sink. A new feature of the power wringer fitted to the "Superheat" is a special finger-grip underneath the wringer to make even easier its closing by hand. Also on the stand will be a smaller "Powerglide" washer fitted with an automatic wringer operated by a foot control. It can be fitted with a heater and is claimed to have the fastest washing time of any machine of its type. All "Servis" washers are available in contemporary two-tone colour schemes as is the company's clothes dryer and airer, also displayed.

An electric wash boiler with the added advantage of a built-in fully geared hand wringer, the "Main 55 Plus," will be shown by R. & A. Main, Ltd. It is also fitted with a special lid into which a hand agitator unit can be fitted if desired. The company will also be showing their recently introduced "Mainspin" spin dryer and the "Main 36" 3·6 cu ft refrigerator, claimed to be the first British refrigerator with a ten-year guarantee on its sealed cooling unit.

Burco, Ltd., besides exhibiting their well-known range of electric wash boilers and washing machines, will be showing their "Tumblair" heat-controlled electric clothes drying machine. It has a capacity of 5 lb dry weight of clothes and once the required drying time has been selected and the automatic timer set the machine can be left unattended and will cut out automatically. The approximate time for drying a full load, ready for ironing, is 60 minutes.

Pride of place on the Jackson Electric Stove Co.'s stand will be given to their recently introduced "Joy" model 396J electric cooker, with eye-level grill and exclusive oven roof protector. Although the emphasis will be on timer-controlled cookers, and the 394, 391 and 390 "Joy" series will be shown, the popular 194J with cast frame and sheet steel contruction will be displayed in two-tone ivory and in all-white vitreous enamel. A special feature will also be made of the 390JO independent oven and the 293JH cooking unit, both of which may be bench mounted at whatever height suits the user. The Jackson "Jill" 3 and 1½ gal water heaters will be shown, together with the 908/909 wash boiler, a complete range of radiant type fires and 1 and 2 kW "Masterpiece" convector heaters.

A redesigned version of the "Tricity 528" electric cooker, to be known as the "Popular," will be shown for the first time by Tricity Cookers, Ltd. Although similar to the original "528" in appearance, it has several new design features including a large splashplate and improved handles and fittings. An automatic cut-out is fitted which restricts current loading and enables the cooker to be used from any power point. If maximum loading is desired, however, the necessary adjustment can easily be made. A spacious cupboard, which forms the base of the cooker, is supplied as a separate unit. The company will also be displaying the larger "Viscount" cooker, a family-

Right: "Main 55 Plus" washing machine (R. & A. Main, Ltd.)

Burco "Tumblair" drying machine

Morphy-Richards "Astral" spin dryer

"Servis" "Superheat" washing machine (Wilkins & Mitchell, Ltd.)

Parnall (Yate) "Thor Automagic" model 260 "Spin-dry" clothes washer

Revo "Roto-Iron" rotary table ironer

sized model with an extra large oven. This cooker also has the choice of left- or right-hand hinging for the oven door and all controls are mounted at eye level. A luxury cooker, of completely modern design with no optional extras, will also be seen on the stand. Apart from its name, the "Marquis," further details are not available at the time of going to press. Another exhibit will be the Tricity suction polisher, an appliance which combines the floor polishing action with the removal of dust and dirt. Features include the provision of a floor light to illuminate the working area, and disposable dust bags.

Tubular-sheathed heating elements as used in domestic appliances such as boiling plates, oven and grill elements, washing machine heaters, urn and kettle elements, percolator and iron elements will form the chief exhibits of the Backer Electric Co., Ltd., emphasis being placed on a new range of boiling plates with vitreous-enamelled reflectors.

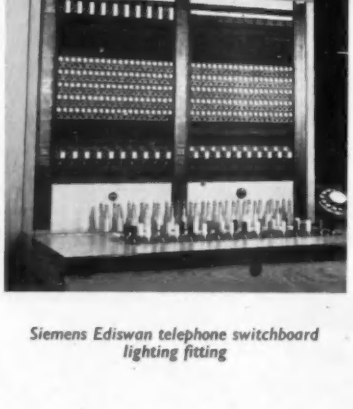
The Tetra Engineering Co. will be showing mineral-embedded tubular-sheathed elements for use in many fields including water, chemical and oil immersion, domestic cooking and heating, refrigeration and infra-red drying. Of particular interest will be the new finned elements for use in heat exchangers, oil heating, grain and crop drying, convection heating and infra-red drying and heating. These can be supplied in lengths up to 12-14ft and are available in copper, mild and stainless steel and aluminium, straight or bent to meet individual requirements.

Bulpitt & Sons, Ltd., besides exhibiting their well-known range of "Swan Brand" electric kettles, together with other electrical appliances including coffee percolators, toasters, urns, blankets and immersion heaters, will have on show for the first time the new "3000" series of "Swan Brand" ground base aluminium holloware for electric and heat storage cookers. The complete range has a new design of handles and lid lifts in an attractive cherry red colour.

Many items are included in the Ferranti display. Among products of the domestic appliance department will be the Mark II "Fridge-Heater" domestic heat pump and panel fires. Meter products will include house service types, with repeater dials, and a "billing" meter which offers in a simple form a solution to the problems of meter reading. The sample meter exhibited prints the kWh recorded in figures by the use of carbon paper, but various alternatives are practicable. The various stages of manufacture of distribution transformers will be shown photographically in the form of a flow chart and high-voltage testing equipment will be shown in the form of two large colour transparencies. The products of the instrument department will be represented by a selection from a wide range of indicating and industrial panel instruments including hermetically-sealed types and the company's 11 kV pole type clip-on ammeter will also be on display.

A new fluorescent surface-mounted diffuser fitting will be among the exhibits of the A.E.I. Lamp & Lighting Co., Ltd. The fitting, specially suitable for commercial interiors where appearance and low surface brightness are important, will be mounted on a false ceiling in the central area of the stand. It consists of a "Bonderized" sheet steel box, exterior finished in black, and either an opal polystyrene louvre or a "Perspex" diffusing panel. The control gear is contained at both ends of the fitting, which has detachable end-plates to assist maintenance and facilitate removal of the louvre or diffusing panel. A "Satina" opal glass three-shade light fitting (G4005/3/4503), representative of a range of over 70 units, which has gained a "Design of the Year 1958" award, will also be displayed. Among fluorescent fittings will be a submersible fitting for use with a single 80 W 5ft lamp; a 5ft single-lamp dustproof fitting; the "Watershed" fitting designed for use in humid atmospheres; an anti-corrosion fitting, which is specially suitable for humid atmospheres in chemical works, etc.; and the A.E.I. flameproof fitting designed for safe operation where inflammable vapours and explosive gases may be present.

A novel approach to telephone switchboard lighting is provided by new fittings to be shown by Siemens Edison Swan, Ltd. These are available in complete units which can be made up to illuminate a switchboard for any number of positions. A special louvre between twin 2ft 20 W fluorescent tubes prevents the downward light from reducing the contrast of the indicator lights, and a "Perspex" panel overhead allows a diffused light to supplement the general lighting of the exchange room. A 12 V, 50/40 W double-filament automobile headlamp bulb and a 1,000 W quartz infra-red lamp, suitable for paint drying purposes which can also be used in the

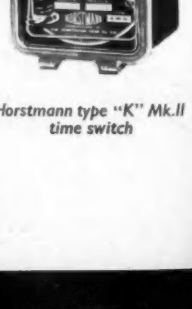


Siemens Ediswan telephone switchboard lighting fitting

Ground base fish fryer from the "Swan Brand" series "3000" range (Bulpitt & Sons, Ltd.)

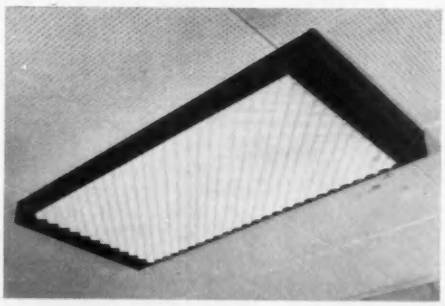
Left: Backer 2kW type 87V1 boiling plate with vitreous enamelled reflector

Maclaren type MO rod pattern oven thermostat

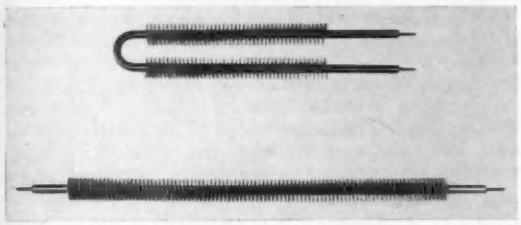


Horstmann type "K" Mk.II time switch

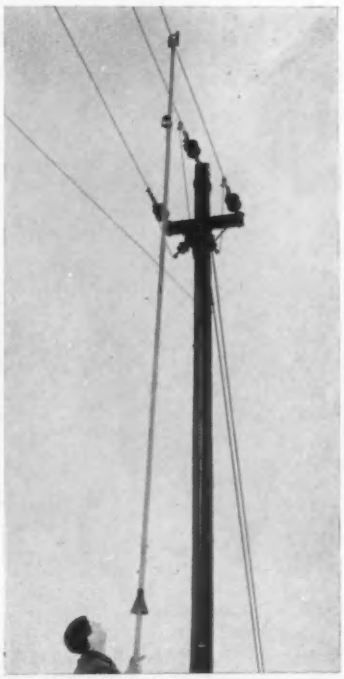
Sangamo Weston model S200-7 single-phase watt-hour meter



A.E.I. shallow type surface diffuser fitting



Two typical examples of Tetra finned elements



Right: Ferranti 11 kV pole type clip-on ammeter

kitchen as a source of heat for infra-red grills, are other new developments. There will also be a new 500 W miniature projector lamp, designed to operate from mains voltages, and this can be seen together with a recently developed 1,000 W MEX/D xenon discharge lamp which has a peak arc luminance of 20,000 stilbs.

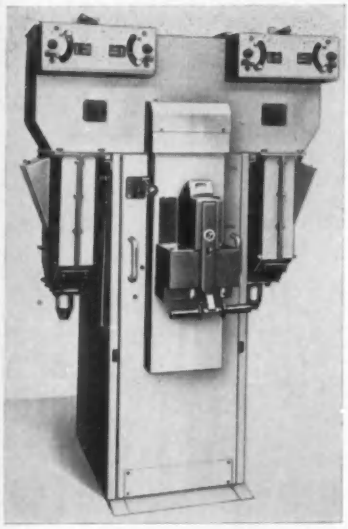
Prominent among a range of Siemens Ediswan fluorescent lighting fittings will be the twin 4ft 40 W " Congress " model. The absence of the usual wall-mounting brackets and control gear box is an unusual feature in the " Firth-Bay " street lighting lantern which will be on view in addition to the " Kuwait " twin street lighting lantern. Among cable exhibits will be a section of 33 kV type HSL submarine power cable and a battery display will include an industrial cell, type WMN 25, weighing one ton.

Atlas Lighting, Ltd., will have as their leading exhibit the " Sylvalume " complete wall-to-wall fluorescent lighting system which can be installed easily and quickly in old or new buildings at a cost comparable with any normal suspended ceiling and its lighting fittings. The lighting trunking is supported at convenient points from the building structure and carries the control gear and cables for the tubes. Cross-beams hold the fluorescent tubes, which can be fixed at any point along the beams. An aluminium grid, based on the 3ft module, is suspended from the trunking and supports 3ft square vinyl sheet diffusers of different design which can be arranged and rearranged as desired. Another item, the " Atlantic " range, is based on a standard chassis design in 8, 5 and 2ft sizes and offers nearly 400 different fluorescent fittings for almost every application. Also to be seen will be the recently-introduced range of incandescent display lighting fittings formed from interchangeable components from which over fifty combinations are claimed to be possible. Domestic fittings to be displayed will include the " Social " range and the " Kitchenlight," a 4ft 40 W fluorescent fitting with an end-shield which houses a combined ballast lamp and switch canister.

A newly-introduced model S200-7 single-phase watt-hour meter, available in 10, 40 and 80 A ratings, will be shown by Sangamo Weston, Ltd. It is a completely new meter and embodies many outstanding aspects of design evolved over 60 years of meter manufacture. The meter display will also include polyphase types as well as rotating substandards, test blocks and other metering accessories. A representative selection of the range of " Sangamo " synchronous time switches will include 24-hr dial types, solar dial types, change-over models, short-interval switches, process timers and hour meters. The type " G " motor and the model " S7 " motor unit will also be exhibited, and among the " Weston " instruments on show will be examples from the ranges of laboratory standards, portable instruments, panel and switchboard instruments and relays.

Robert Maclaren & Co., Ltd., will be exhibiting for the first time a rod-pattern oven thermostat, the " Maclaren " type M.O., for domestic cookers. Also new will be a dual-purpose thermostat for greenhouse use. Known as the type ACS/G rod pattern, it is for the control of either air temperature or soil heating. The type M.B. thermostat for domestic water heating will be shown. This is available with standard stem lengths of 7, 11 and 18in and can be supplied either with a fixed temperature setting or with an adjusting knob covering standard temperature ranges. Other exhibits will include the type ACM-R room thermostat which is now available in an off-white finish as an alternative to the standard walnut finish, and the " Thermo-Time " regulator, an instrument that will provide a temperature-time programme for automatic heating installations.

Included in the Horstmann Gear Co.'s display of electric time switches, flasher units, cooker timers, etc., will be the latest types " K " Mark II and " Y " Mark II switches which are in great demand for the automatic control of street lighting and for special off-peak tariff control. The former is a synchronous motor driven model suitable for use on 200/250 V, 50 c/s, while the type " Y " switch is a compact unit, electrically wound and incorporating



Johnson & Phillips type NX ring main unit

Reyrolle type JK outdoor rural fuse-switch unit

a 12-hr spring reserve. Other switches used extensively for off-peak-tariff control will include the type "V"/SRS and EH/SRS, both of which are synchronous motor driven models incorporating a three-day spring reserve.

A new machine for producing spiral elements from 1 to 0·12 mm diameter resistance wire will be presented by Hall & Pickles, Ltd. It is the "Oakley" coiling machine and is suitable for close-wound, double-helix or space-wound spirals. The company will also show their "Nicralloy" and "Kanthal" high-temperature electrical resistance alloys and a new "Kanthal" alloy for furnace temperatures up to 1,600 deg C.

On the stand of M.K. Electric, Ltd., a wide range of electrical accessories for domestic and industrial installations will be shown. Recent introductions include a range of 20 A switches and additions to the "Gridswitch" range. The latter will be shown in its entirety, demonstrating the versatility of the many interchangeable units which can be built up into an infinite number of complete assemblies of all types, using standard components throughout.

Lightweight compressors and compression jointing equipment for use in conjunction with overhead power lines, with other line accessories and a range of Bowthorpe line taps, will be shown by Tate Engineers, Ltd.

Models of two alternative low-temperature radiant warming systems suitable for off-peak operation are being shown for the first time by Panelec (Great Britain), Ltd. The first will show the company's rewirable system which has twin-core "Bestos" insulated lead-sheathed heating cables drawn into specially shaped cable housings for rapid diffusion of heat through expanded metal into the concrete. A feature of this system is that the access trough covers may be filled with screed and surface finished to match the surrounding floor area. The other model is of an embedded system using p.v.c. insulated heating cables. The cables, which are supplied with 12ft long cold tails and factory-made joints, are fixed at the required distance apart in a patent plastic T-section cable grip. Full details of controls recommended for operating the "Panelec" systems, including thermostats, relays, time clocks and thermo-time regulators will be available.

Wandleside Cable Works, Ltd., and its associated companies, Irish Cables, Ltd., and Wandleside Warren Wire Co., will combine in exhibiting an even more comprehensive range of wires, flexibles and cables than in previous years. Among the more recent developments of the company will be the "Florawarm" system of floor-embedded heating cables, "Hortiwarm" glass-house and soil-warming cables and accessories, "Hitem" heat-resisting thermoplastic insulation and "Warrenex" p.t.f.e. insulated wires and flexibles.

"BICC Cables Serve the World" will be the theme of the British Insulated Callender's Cables stand and will be illustrated by a large map and a comprehensive display of low-, medium- and high-voltage cables, including 33 kV cables having seamless corrugated aluminium sheaths. Of special interest will be an exhibit of l.v. plastic mains cables now available with shaped conductors presenting an economical alternative to conventional paper insulated mains cables.

On the Henley stand, cables for a wide variety of uses will be shown. Power cable exhibits will include a display showing the work which the company is carrying out at Chapelcross nuclear power station where 220,000 yd of Henley cables is being installed. Cables for railway electrification will include a new 25 kV concentric oil-filled cable. Also displayed will be various types of signalling cables, pilot supervisory cables and a sample of 33 kV three-core oil-filled cable. A selection of distribution equipment will include service fuses, earth-leakage circuit-breakers, distribution panels and the new Henley terminating gland for p.v.c. insulated wire-armoured cables.

A display of p.v.c. insulated mains cables, together with the relevant methods of jointing, will form part of the exhibit of the cable section of Johnson & Phillips, Ltd. On the same stand the plant section of the company will present their recently introduced type NX 400 A ring main unit which comprises a standard metalclad oil circuit-breaker with two wing oil switches assembled into one common structure. Another plant exhibit will be a 300 kVA distribution transformer to B.E. Spec. T1.

Prominent among the exhibits of A. Reyrolle & Co., Ltd., will be one of their type JK outdoor rural fuse-switch units fitted with ASTA-certified powder-filled cartridge fuses of their own manufacture. These recently developed fuse-links are available in ratings of from 5 to 50 A (in steps of 5 A) and also of 60 A, all having a rated breaking capacity of 250 MVA at 11 kV. There will also be a selection of relays on show including a new flush mounting case with withdrawable element. A working demonstration of an alarm relay is also included as well as examples of hand-trimmed and electromagnetic semaphores for control-board indication.

The principal South Wales Switchgear exhibit will be a complete 33/11 kV outdoor package type substation. The unit will be installed at the exhibition on an open site and will comprise an air insulated 33 kV, 1,000 MVA unit, an air insulated 11 kV, 350 MVA unit and a tripping unit installed in a prefabricated housing. On the company's indoor stand "R" type switch-fusegear for 440 V service up to 800 A will be on show. The equipment may be fitted with a wide range of auxiliary components to make a composite switch-fuseboard suitable for any type of m.v. installation.

Owing to the restricted exhibition space the South Eastern Electricity Board will not be displaying the usual variety of appliances this year. There will, however, be three panels dealing respectively with water heating, floor warming and convection heating and a new convector, designed on classic lines to blend with period furniture, will be specially displayed.

Control and Relay Panels

The Unit Construction System

By R. E. MARTIN, D.F.H., A.M.I.E.E.*
and J. E. TOMS, B.Sc., Graduate I.E.E.*

THE construction of protective relay and control panels by the traditional method of a "tailor-made" assembly of large sheet steel plates on angle frames suffers from certain disadvantages. The use of large pieces of sheet steel results in a heavy assembly, rendering transport difficult, and modifications to the panel drilling layout are almost impossible unless the whole front panel is scrapped and replaced by a new sheet.

The unit construction system described provides a more convenient and flexible arrangement which is based on principles already accepted by telecommunication engineers, i.e. standardised circuits resulting in a minimum number of standard sub-assemblies from which any desired combination can be built up. It is often found necessary to add stiffening bars to prevent vibration of the front panel, in the traditional construction, to avoid inadvertent operation of protective relays. The unit system results in these difficulties being reduced since the whole construction is lighter, but is nevertheless more rigid whilst retaining flexibility for modification or extension.

Although not incorporated in the prototype, it would be advantageous to mount the whole relay panel on suitable shock-absorbing mountings to absorb low-frequency energy transmitted through the floor, since frequencies less than 200 c/s appear to be the most dangerous in causing inadvertent operation of protective relays. Preliminary work which has been done on the vibration qualities of integral sheet steel relay panels has revealed that they have resonant frequencies in the region which causes operation of protective relays.

Pre-formed Cabling

The wiring of the conventional panels is usually carried out entirely by hand and fitted *in situ* behind the panel. With the unit system, it is possible, with a certain measure of standardisation of wiring arrangements in various types of panel, to manufacture the wiring as a sub-assembly which can be placed in position and readily removed should any modification be required. Wiring already formed is much cheaper to provide than individual wires with right-angle bends run separately to each terminal. There are specialist firms who manufacture these cable forms in the manner suggested, and who, by the use of mass production methods, can provide the whole wiring for a complex protective relay panel at a comparatively economical cost and as a separate sub-assembly. By the use of crimped terminations and cheaper methods of numbering the wires than the normal ferrules, the costs are still further reduced.

Although protective schemes are not yet fully standardised, the use of bundled flexible wires represents a large saving in material and labour as against the use of inflexible wires which need careful pre-forming and have to be attached to the panel at regular intervals by means of cleats.

One of the first objects in the development of the unit system was to provide a considerably cheaper form of construction than that normally used for control and relay cubicles. It was decided to utilise the standard 19in rack construction which is widely used throughout the world for telecommunication equipment. This is a comparatively cheap form of construction in which the front panel is made up of a number of standardised pieces of plate which are always 19in wide but may be of various standardised heights. Any number of panels of the various heights may be installed in any position on any standard rack. The standard racks are easily extended by removing the side doors and bolting another bay alongside. The appearance of a single bay is illustrated in Fig. 1. The present total cost of the metalwork of the standard cubicle and front plates is about £43. Sections other than the terminal block sections and the blank sections are 8¾in deep; the terminal block sections are 5¼in deep.

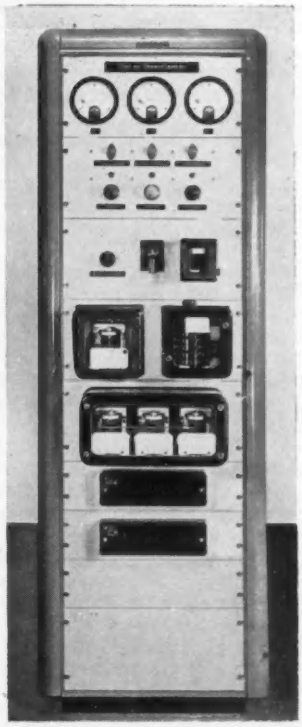


Fig. 1.—Demonstration 19in unit construction

To take full advantage of this scheme, it is essential to introduce some measure of standardisation into protective relay and control circuits. For example, it may be decided that 32 different types of a complete panel system are required, utilising 50 different types of relay or other items of equipment assembled in various formations to provide the 32 different types of circuit. It is suggested that the 50 types of relay should each be individually mounted on the 19in plates, which would involve standardised drillings and piercings of these plates. These could be held in store with the relays ready mounted, together with blank plates. When required for a protective relay or control panel, it would only be necessary to draw from stores the appropriate plates, with the relays ready mounted, in order to build up on a standard rack the appropriate pieces of equipment required for that particular substation, filling in the spare panel space with blank plates. This is illustrated in Fig. 2.

A ready-made cable form for the requisite circuit would also be held as a prefabricated item in store and could be quickly assembled to the relays, etc., on the appropriate plates to provide a complete panel in the minimum time. Fig. 3 illustrates the appearance of the rear of the panel with the side doors and the rear door opened to show the cable forms.

The great advantage of such a system lies in its cheap-

* Central Electricity Research Laboratories.

ness, extreme flexibility and the possibility of modifying a panel at short notice without any drilling or piercing of panels being required on site. Protective relays have been known to operate owing to vibration caused by drilling operations on adjacent panels. Also, there will be no steel filings to cause trouble with the relays.

With the present shortages of skilled personnel, it is obviously uneconomic to occupy engineering and drawing office staff on individually designing panels when this work could be done once and for all in a fully comprehensive manner to provide the standardised plate designs suggested.

Various designs of rack, both open and enclosed, are already easily available from a number of manufacturers, the drilling dimensions being standardised so that all plates can be mounted on any make of rack. The cost of this system contrasts very favourably with the cost of a conventional relay panel without the relays fitted. The cost of punching and drilling is low due to the ease of handling the small size of plate.

Panel Wiring

The wiring of the cubicle illustrated was carried out in flexible " Neoprene " insulated wire (type " Unipren 18 ") which was chosen for its high abrasion resistance, low liability to bending or vibration fracture, ease of forming, oil resistance, and relatively economical cost. While the cable forms in the demonstration models have been made by hand *in situ*, in a production version with a standardised wiring system they would be made up from drawings by a contractor specialising in this work. The cable form in the demonstration is laced with nylon cord coated with p.v.c. This is superior to normal p.v.c. lacing thread as stretching is obviated. The wiring is in 70/·0076, which is preferable to 7/·029 for this particular type of construction. The latter could be used if preferred.

All the connections are crimped to suitable lugs for connection to the terminals except in one or two cases where soldering is unavoidable. In a production version, arrangements would be made for all connections to be bolted in order to facilitate quick removal of the cable form or interchanging of the individual relay mounting plates.

The wires are numbered with " Twinlay " cable markers. These markers are made of p.v.c. and are therefore resistant to mould growth of any sort. Conventional interlocking cable markers are prone to support mould growth and after two or three years' use in outdoor switchgear terminal boxes or junction boxes, are unreadable. The markers are threaded over the insulation with a lubricant and are colour coded according to the standard number/colour code as well as being marked with the corresponding figures. The numbers are marked reading from the wire end. Hellermann sleeves are applied to strengthen the junction with the crimped terminals.

Most of the components used in the experimental cubicle are of conventional pattern. The small indicating lamps contain under-run bulbs and are very much more economical in cost than the conventional patterns. The terminal blocks are the standard S.B.A.C. aircraft type. They are designed for crimped connections from the panel wiring and from the multicore cable tails. The crimping ferrules are silver-plated and are rated at 19 A. Tensile tests on crimped ferrules have revealed that the wire breaks before it can be withdrawn from the ferrule.

All the metalwork, including the plates, is passivated and treated with a stove enamel finish after the holes have been pierced. This ensures that even the edges of the holes remain rust-free after a period of use in a humid substation building.

Fig. 2.—Control and relay panel showing side doors and rack construction

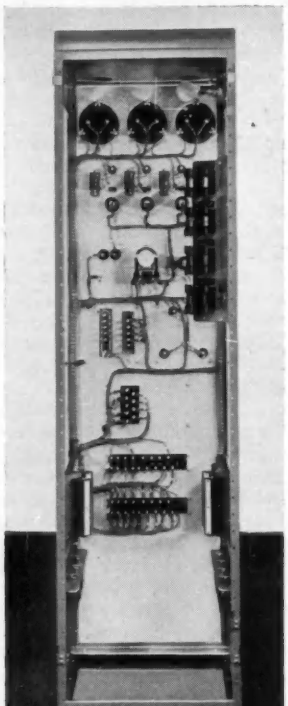


Fig. 3.—Rear view of panel showing pre-formed cabling

Future Developments

Possible future developments of the unit construction system demonstrated are the incorporation of slide-out panels for supporting items having a considerable weight such as auxiliary C.T.s. Standard roller slide drawer assemblies are available for use with this rack system and can be utilised to give mountings of this type or to provide drawers containing drawings or spare fuses, etc. By the addition of the requisite unit, a small desk writing area can be provided projecting from the front of the cubicle. The 19in rack mounting systems can also be used to construct control desks and other items of rack-built equipment of any shape or size, providing that each plate is 19in wide and that the plates have standard depths. The plates can be stiffened by folding the edges of the individual plates.

Any number of the racks illustrated can be mounted side by side and bus-wiring could be

arranged by means of a suitable connector. It should be emphasised that the cubicles are well ventilated and are therefore unlikely to support fungus growth which might result in low insulation values.

Future development should aim at standardisation of relay and control circuits to a basic minimum number of types using the minimum number of standard plates each carrying the appropriate relays or other components. Cable forms could then be supplied as a stock item.

An alternative future development lies in the possibility of applying modern techniques in plug and socket connectors to the junction of the cable form to the relays. Recent developments in the design of high quality plug and socket connectors having excellent current-carrying capabilities and high insulation resistance with adequate voltage rating, have led to the production of several designs of connector which are now becoming commercially available. All such connectors which have been tested comply with Interservices Standard RCS 321 Class H2 and have proved capable of carrying 100 A for short periods. All contacts are of silver-plated beryllium copper separated by a phenolic moulding. The Interservices Standards group of specifications are issued by the Ministry of Supply in conjunction with Defence Specifications and are intended to cover all components used in vital equipments by all the Armed Forces and the G.P.O. The standard of reliability which such components achieve is in advance of those available from other sources and there is much to be gained by the adoption of these Standards wherever they are applicable in the power supply industry. These plugs and sockets have interlocking shells which can be orientated in six different combinations, thus preventing the mating of incorrect plugs and sockets. The cases of the plugs are of electro-tinned brass and so mated that no mechanical stresses are transferred to the pins or sockets. Experiments show that it may be possible to replace the studs on the back of a conventional relay with such a connector. The connectors are dustproof, pressure-tight and lockable. They will therefore prevent the ingress of moisture or dust to the relay case, which could then be properly sealed. Rapid disconnection of the cable form could be effected by the release of the positive locking device and withdrawal of the connector. Such a system would greatly facilitate the rapid assembly or modification of relay and control panels and would also enable the wiring to be tested and automatically checked as a complete subassembly by mass production methods.

Conclusion

It is considered that standardisation of control and protective gear panels in any given organisation would enable large savings to be effected. The scheme outlined is but one way of achieving a practical realisation of this aim by an extension of the already widely used 19in construction, popular in the telecommunication field throughout the world, to cover the requirements of power engineers.

If sufficient engineering effort were made available to launch such a scheme on a sound basis, much individual engineering effort in the future would be saved, as modifications, which are invariably required, could easily be accommodated by changing a given unit. By the widespread use of such a scheme, plant outage time could be reduced. Completed panels required at short notice could be assembled from stock items and servicing would be rendered easier than at present because fewer skilled staff would be required on site, and testing arrangements could be provided on a comprehensive scale at a central point, thereby enabling higher efficiency to be achieved.

The design and construction of the panels was carried out at the Central Electricity Research Laboratories, Leatherhead, and the authors wish to thank Dr. J. S. Forrest, Director of the Laboratories, for permission to publish this article. They also thank the Southern Electricity Board for their co-operation.

INDUSTRIAL RESEARCH ASSOCIATIONS

THE Department of Industrial and Scientific Research has now published a summary of the work of the Industrial Research Associations in the Government scheme. The report, "Research for Industry" (H.M. Stationery Office, 7s 6d), was referred to in the D.S.I.R. annual report.

There are now 39 associations in the Government scheme together with seven Research Councils on the same pattern. They receive from the D.S.I.R. annual grants roughly proportional to the income they raise independently. The Department also aids three bodies giving a common service to industry, Aslib, the National Institute of Industrial Psychology and the Commonwealth Mycological Institute.

The Research Association is essentially a voluntary body set up by a group of firms to study their common scientific and technical problems. This report records in brief the progress made by grant-aided associations in a few important lines of research during the 15 months ended December, 1957. Previously this summary has been included in the D.S.I.R. annual report but in future it will be published separately for each calendar year.

Among various summaries given in the report, the British Electrical and Allied Industries Research Association carried out work on development of an electric tractor and the destruction of pests by irradiation. Other work includes further study of the intrinsic electric strength of plastics and a capacitor using very thin aluminium oxide films had been developed to the stage of possible industrial application. A 2·8 MV surge generator having a stored energy of 130 kW-sec has been installed in the new laboratories at Leatherhead. With this equipment it will be possible to carry out full-scale tests on the highest voltage apparatus likely to be used on transmission systems.

A summary of the work carried out by the Parsons and Marine Engineering Turbine Research and Development Association is mainly concerned with the steady progress which has been made in design improvements to marine turbine propulsion machinery.

A number of member companies of the British Non-Ferrous Metals Research Association are interested in the construction of nuclear power stations and as a contribution to the metallurgical information received in this field the Association has begun an investigation on certain properties of thorium and its alloys.

Other summaries include the work of the Heating and Ventilating Research Council, the British Internal Combustion Research Association and the British Welding Research Association. The report includes an appendix giving details of publications issued by the Research Associations.

CONVENTION "WHO'S WHO"

Owing to an unforeseen delay, the list of delegates to the British Electrical Power Convention (the Convention "Who's Who") will not be available in advance. Copies will be distributed at the Dome, Brighton, on Monday morning next.

VIEWS on the NEWS

By REFLECTOR

LAST week I was privileged to listen to a tape record of conversations between the late Sir James Swinburne, Lady Swinburne, and Messrs. H. V. Potter and E. W. A. Jefferies of Bakelite, Ltd., made a day or two before Sir James's hundredth birthday. It was most fascinating to hear Sir James recalling his early days—seventy or eighty years ago—and particularly his references to his association with Sir Joseph Swan and Col. R. E. B. Crompton. One interesting passage dealt with the raising of the bullion ship *Egypt* sunk off the coast of France during the first world war. Sir James was responsible for the work and in locating the ship employed an echo-sounding system—a novelty in those days. Above all, I was again impressed by his versatility. He was not only one of the first electrical engineers, concerned with all aspects of the nascent electrical industry, his interests extended into many other fields, and particularly horology. In the recording he was evidently proud of his introduction of German watchmaking technique to London and to the United States, where (as he said) a man, however young, was highly regarded if he achieved something. He claimed that it was this which really established his reputation in this country. The recording showed that Sir James retained to the end a lively sense of humour.

* * *

John Davy in last Sunday's *Observer* commented on an exhibition being arranged in Brussels by the Institute of Patentees. He said:—

> "Some trouble is being caused by the electricity supply, which does not suit some of the inventions. It does not suit a machine for giving singing lessons, which keeps filling the hall with rumbling scales sung in a bottomless bass."

A matter of frequency by the look of it. But what sort of a machine is this I wonder? I would have thought that gramophone records or tapes would have been sufficient. Another item in the exhibition is a washing-up machine which is claimed to remove day-old egg from plates—quite a thing, as washers-up will appreciate.

* * *

I was aware that the job of a wayleaves officer was a pretty difficult one but I did not appreciate how much there was of it. Mr. R. G. Still, estates and wayleaves officer of the Mid-Sussex Sub-Area of the South Eastern Electricity Board, in an article in *Public Service,* says that he and two colleagues negotiated 120 sites for transformer stations and over 450 wayleaves for transmission lines last year. I suppose that many of these went through without much opposition but sometimes negotiations take "weeks, months, or even years." Apart from individuals, Mr. Still mentions planning authorities, official committees, "pressure groups" and others who voice strong views about amenity. He admits that they have one advantage over his "opposite numbers" in the generating divisions; they are dealing with an immediate local need for electricity and not with seemingly remote plans for power stations and grid lines. Mr. Still says that although the Board has compulsory powers it has exercised them only twice in ten years. But I imagine that the knowledge of the existence of these reserve powers may induce a more amenable attitude on the part of some landowners.

* * *

Dealings in "futures" are common in a number of commodity markets. Now apparently something of the kind has extended to the sale of property. In a recent issue of the *Evening Standard* I observed an advertisement for a bungalow at Herne, Kent, in which one of the selling points was "60 min. journey London (when electrified next year)."

* * *

Here is an extract from the report of a local advisory committee of the electricity supply industry which appears in the current number of *Northern Lights* (the magazine of the N.W., Merseyside and N. Wales Region, C.E.G.B.):

> "It was ascertained that the bars of soap varied in size: the storekeeper had a machine which cut pieces so many to the bar, this was needful for stock recording purposes. It means that some pieces may therefore vary in volume but as the amount was not rationed, if any man due to the nature of his job needed more soap then he could ask his chargehand for a further piece."

Obviously cleanliness in a power station is a complex matter.

* * *

Half-a-century ago coal was so cheap and abundant that the *Electrical Review* (19th June, 1908), in common with others, doubted the wisdom of proceeding with hydro-electric schemes except where conditions were particularly favourable. Nevertheless, it admitted that the situation might be radically changed in a few years, as it undoubtedly has done. The *Review* said:—

> "Whether or no Steinmetz' recent estimate that some amongst the younger men of the present generation of engineers will live to see the exhaustion of the world's supply of anthracite, is fulfilled, there is no escape from the conclusion that with the world's rapidly increasing annual consumption of its limited supply of coal, the end is in sight and that in the near future there will be a steady increase in the price of coal."

Reference was made to the price of 10s a ton then current and it was thought that at 40s a ton steam-produced electricity would become too dear and "the present century would doubtless see the complete supersession of this expensive plant by hydro-electric plant." There was no suggestion that with its limited water resources this country would be left standing.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Sir John Dalton, M.I.E.E., F.C.I.S., Barrister-at-Law, announced at the annual meeting of W. T. Henley's Telegraph Works Co., Ltd., held on Friday last, his intention to resign from the chairmanship of the company following the meeting and that he would be succeeded as chairman by **Sir Alexander Sim,** who joined the board in 1956.

Sir John joined the County of London Electric Supply Co. in 1927 and became director and general manager of the company and its associated companies. During the war years (1939-1945) he acted as Regional Controller of Fuel and Power for London and S.E. England and was knighted in 1942. In 1945 he was appointed a director of the London Power Co., and Central London Electricity, Ltd. Upon the nationalisation of the electricity supply industry he relinquished this position and joined the Cable Makers' Association as director. Sir John was appointed chairman of Henley's in 1953. In 1956 he was president of the British Electrical Power Convention. He will continue to serve on the board of Henley's.

Sir John Dalton

Sir Alexander Sim

Sir Alexander Sim spent the early part of his career in India, joining Andrew Yule & Co. of Calcutta in 1930. He was appointed director in 1939, deputy chairman in 1948 and chairman in 1953, holding this position until 1956 when he retired from India. During this period he acted as Commissioner for the Port of Calcutta from 1950 to 1955, was vice-president of the Bengal Chamber of Commerce and Industry in 1954-55 and president in 1955-56. He was also president of the Chambers of Commerce of India in 1955-56. He also served on numerous trade associations and financial committees in India. Returning to this country in 1956, he became a director of Yule Catto & Co., Ltd., East Indian merchants, London, and in June last he joined the board of Henley's.

Mr. G. W. Paterson has been elected president of the Electrical Society of Glasgow. The vice-president is **Mr. R. A. Forster** and the hon. secretary **Mr. J. T. Cook,** who succeeds **Mr. P. Orr.**

The Kilmarnock and District Electrical Society has elected the following officers:—President, **Mr. W. Linton;** vice-president, **Mr. T. B. Wilson;** hon. treasurer, **Mr. A. H. Reid;** and hon. secretary, **Mr. F. Anslow.**

Mr. S. Smith, chief designer, and **Mr. E. G. Holberry,** works manager, of the E.M.B. Co., Ltd., West Bromwich, have been appointed directors of the company.

The Parents' Day of the **British Thomson-Houston Co., Ltd.,** Rugby, was held on 31st May when over 600 parents, friends and other visitors were entertained.

In the morning some of the guests visited the Rugby College of Engineering Technology and the special training drawing office. In the afternoon the visit to the main works commenced in the new education building, where a number of examples of B.T.H. products were displayed. The visitors were then conducted on a short tour of the various factories, assembling later in the afternoon in the main dining hall, where Mr. H. E. Cox, manager, Rugby Works, welcomed them and introduced the Mayor of Rugby, Councillor Mrs. E. F. Monk.

Mr. C. Grad, manager, Education Department, reviewed the technological progress made during the last fifty years and stressed the importance of research and education if Britain was to maintain her position in the world of the future. A brief speech of appreciation and thanks on behalf of the parents was made by Prof. C. F. W. Illingworth, C.B.E., whose son is a student apprentice, following which the visitors travelled in coaches to Coton House, the main apprentice residence, where tea was served in the new dining hall.

The proceedings closed with a demonstration of fire fighting by members of the Coton House fire brigade, all of whom are apprentices resident at the house.

Mr. A. R. Gale has been appointed London manager of Dorman & Smith, Ltd. Mr. Gale has been with the company for seven years and his thirty years' experience in the electrical industry includes seven years' service with Crompton Parkinson, Ltd., and six years as chief engineer of a circuit of theatres for the Gaumont Super Cinemas.

Mr. A. R. Gale

Mr. S. A. Gregory, B.Sc., M.I.Chem.E., has been appointed technical manager of the Dryer Division of Birlec, Ltd.

The annual travellers' launch party of the **General Electric Co., Ltd.,** was held on 31st May when Mr. and the Hon. Mrs. Leslie Gamage invited the party to visit them at Foxhill, Earley, which they will soon be leaving. Foxhill was acquired some forty-three years ago by the late Lord Hirst of Witton. The party totalled 225 and included some overseas representatives and pensioners.

At the annual general meeting of the South Wales Branch of the Association of Mining Electrical and Mechanical Engineers, held at Cardiff, on 29th May, **Mr. G. H. Bowden,** M.I.E.E., was invested as president.

Parents examining samples of work in the B.T.H. Apprentice Training Department

Mr. G. H. Bowden (left) the new president of the South Wales branch of the Association of Mining Electrical and Mechanical Engineers with Mr. D. N. Simpson (past president)

Mr. Bowden is manager of the Cardiff branch of Johnson & Phillips, Ltd. He is seen in the accompanying picture with Mr. D. N. Simpson, B.Sc., M.I.Min.E., the past president, who is the deputy area production manager, planning and reconstruction, of No. 3 Area of the National Coal Board.

Mr. H. J. Furness, F.C.W.A., has been elected president of the Institute of Cost and Works Accountants. He is manager of the Planning and Organisation Department of Hoover, Ltd.

After forty-six years' service with Harland & Wolff, Ltd., Belfast, **Mr. H. C. MacEwan,** chief of the Electrical Department and a director of the company, has retired. On the occasion of his retirement he and his wife received presentations from the management, staff and foremen.

J. A. Crabtree & Co., Ltd., announce that the following sales engineers have now joined the company: **Mr. J. Esau** who has, for the last 20 years, been engaged in the control gear field, first with the Electrical Apparatus Co., Ltd., and later with South Wales Switchgear, Ltd., will operate in South Wales.

Mr. R. Grace, A.M.I.E.E., who will operate in North Wales and North-West England, served an apprenticeship in the electrical contracting industry before gaining industrial electrical experience with three well-known firms in Lancashire.

Mr. J. Munford was previously an engineer surveyor with one of the larger assurance corporations. He has had experience in other sections of the industry and was for some years a development engineer with the State Electricity Commission of Western Australia. He will operate in Southern England.

Mr. J. Esau

Mr. R. Grace

Mr. J. Munford

Mr. G. A. Dwyer has been appointed assistant export sales manager of the Marconi International Marine Communication Co., Ltd.

Mr. Dwyer joined the company as a sea-going radio officer in 1929 and after holding various positions was appointed manager of the Bombay depot in 1952. In 1954 he was appointed manager of Port Said depot, and returned to the United Kingdom when the company's European staff were withdrawn from Egypt in 1956. He leaves for Rio de Janeiro on 22nd June for discussions with the company's Brazilian associates, Cia. Marconi Brasileira.

Mr. U. G. Knight, B.Sc.(Eng.) (Hons.), A.M.I.E.E., author of the article on "Development of 33 kV Networks" in this issue, was educated at Nottingham Boys' High School, University College, Nottingham, and the Royal Technical College, Salford. After spending four years with Ferranti, Ltd., he joined the North Western Division of the B.E.A. in 1948. In 1951 he was appointed development engineer in the Merseyside and North Wales Division of the B.E.A., moving to the Merseyside and North Wales Electricity Board in 1955 as an assistant planning engineer.

Mr. U. G. Knight

Mr. S. Bugden has been appointed eastern district manager for Ekco-Ensign Electric, Ltd. He has been with the company for seven years and is well known in electrical circles in Luton and Bedford.

The annual competition for the **Electrical Trades' Commercial Travellers' Association** (Midland Branch) challenge golf trophy was held at Moor Hall Golf Club, near Birmingham, recently. The prizes were presented by the branch chairman, Mr. S.E. LeMarechal. The winner of the challenge trophy was Mr. J. T. Aitken and the runner-up was Mr. P. M. King, who was presented with a tankard. The visitors' prize was won by Mr. S. C. Tutton. The annual car hunt will be held on 29th June and entry forms can be obtained from Mr. P. J. Kelsey, 123, Abbey Road, Smethwick, Birmingham, 41.

The South of Scotland Electricity Board has appointed **Mr. W. C. Malcolm,** D.S.C., A.I.M.T.A., as accountant of its Clyde Area in succession to **Mr. R. Carson,** who retires on 31st July. Mr. Malcolm has been accountant of the Fife Area since 1949. Mr. Carson, who has been accountant of the Clyde Area since the nationalisation of the electricity supply industry, entered the service of the former Clyde Valley Electrical Power Co. in 1920 and was chief accountant of the company from 1940 to 1948.

Mr. M. W. Munro has been appointed chief purchasing officer to Marconi's Wireless Telegraph Co., Ltd.

Mr. M. W. Munro

Mr. Munro joined Marconi's in 1939 and in 1943 was appointed chief of the material progress section. In 1946 he became chief of the supplies progress division and in 1951 deputy supplies manager. In his new position Mr. Munro will be responsible for all the company's purchasing activities except those of the Basildon Works. His assistant is **Mr. R. M. Carroll,** formerly deputy chief, works subcontracting division. This division is now incorporated into the Purchasing Department. Mr. Munro succeeds **Mr. A. T. Cadman,** who for the past fifteen years has been Marconi's supplies manager, and who now retires after forty-six years, having joined Marconi's in 1912. He became assistant to the technical manager of the Marconi International Marine Communication Co., Ltd., in 1921 and returned to Marconi's Wireless Telegraph Co. in 1923 on the formation of the Central Purchasing Department for the Marconi Group. With Mr. Cadman's retirement the office of supplies manager ceases to exist, being superseded by that of chief purchasing officer.

On 7th June over 200 engineering apprentices received merit awards and indentures from Sir John H. Woods, director of the **English Electric Co., Ltd.,** at a ceremony held in the grounds of the company's hostel at Dunchurch Lodge, near Rugby. The year's examination successes were also announced by Mr. W. Cooper, Principal of Rugby College of Technology and Arts, for some fifty young engineers who entered for external degrees and certificates. M. J. Hartwell, craft apprentice, of Rugby, was the winner of the foremen's shield, R. L. H. Birch, of Leek, Staffs., won the student apprentices' cup, and T. H. Hopkins,

of Penlan, Swansea, was awarded the cup for the best graduate apprentice of his year. Mr. W. G. Thomas, assistant to the works general manager and chairman of the Apprentice Training Committee, presided at the presentation ceremony. The speakers included Mr. E. M. Price, general manager, Rugby; Sir John Woods; Mr. L. Du Sautoy, chief of personnel and training, Rugby; Mr. G. Hosie, chairman of the Foremen's Association; and Mr. M. J. Macfarlane, chairman of the Apprentice Association.

A new type of course for craft apprentices is referred to in the annual report made by Mr. Du Sautoy. In an attempt to reduce the wastage rate of craft apprentices who embark on City and Guilds courses but never complete them, the company has introduced at Rugby a "sandwich course" made up of three months' full-time study each year at the Technical College, instead of the present system of a day a week throughout the five years' apprenticeship.

The **Midlands Radio Industry Golfing Society** held its Captain's Day at Robin Hood Golf Club, near Birmingham, recently. Mr. L. Wise, the captain, presided at the dinner which followed. The winner of the captain's prize was Mr. N. S. Reed, and the runner-up was Mr V. Smytherman. The next meeting will be held on 19th June at Walmley Golf Club, near Birmingham.

The Minister of Power has reappointed **Sir William Holford,** F.R.I.B.A., as a part-time member of the Central Electricity Generating Board.

Mr. R. Speirs, M.I.E.E., M.Amer. I.E.E., previously London manager of the Dorman Smith Group, has joined the Electric Construction Co., Ltd. He will be domiciled at the company's London offices at Bushbury House, 57, Buckingham Gate, S.W.1 (Victoria 3482/3), and will take over responsibility for all sales of moulded circuit-breakers.

Mr. R. Speirs

Mr. S. F. Steward, C.B.E., chairman of the Lancashire Dynamo Group recently presented a set of golf clubs to **Mr. T. A. Atkinson,** B.Sc.Tech., managing director of Dynamo & Motor Repairs, Ltd., a Lancashire Dynamo company. The presentation was made to mark Mr. Atkinson's fifty years of service with the Group. He commenced his training as an apprentice at the Trafford Park Works of the Lancashire Dynamo & Motor Co. (forerunner of L.D.C.) and was assistant chief-of-test at the works from 1914 to 1918 when he became works engineer. In 1920 he became a founder-director of

Mr. S. F. Steward (chairman, Lancashire Dynamo Group) making a presentation to Mr. T. A. Atkinson (managing director, Dynamo & Motor Repairs, Ltd.)

Dynamo & Motor Repairs, Ltd., which was formed originally to service L.D.C. equipment, and has since been developed to provide comprehensive facilities in the field of electrical rotating machinery.

Sir John Hacking, the newly-elected president, was the chief speaker at last Tuesday's luncheon meeting of the **Electrical Industries Club.** In an interesting talk he dealt with the early stages of the electricity supply industry and concluded with a brief reference to the electricity supply legislation ranging from the 1882 Act to those of recent times. Mr. E. G. Batt proposed a vote of thanks to Sir John. Earlier in the meeting Mr. A. S. Lowe (hon. secretary and treasurer) made a presentation of an inscribed volume of Shakespearian tragedies to Mr. A. B. Wildsmith in recognition of his services. Mr. Wildsmith is the first elected honorary member of the Club.

The **Birmingham Electrical Golfing Society** held its spring meeting recently at Sutton Coldfield Golf Club. Mr. W. Horrocks, the president, was in the chair at the dinner which followed. The prizes were presented by the non-playing captain, Mr. T. C. Browne. The winner of the spring trophy was Mr. L. Rex and the runner-up was Mr. W. Horrocks.

OBITUARY

Mrs. V. Watlington.—We extend our sympathy to Mr. Victor Watlington, M.I.E.E., former director of the British Electrical and Allied Manufacturers' Association, on the death of his wife, Mrs. Mabel Elizabeth Watlington, on 5th June.

Mr. C. W. Johnson, formerly of the Rangoon Electric Tramway & Supply Co., Ltd., died on 30th May in London. He was educated at Beaumont and Oxford, and served with the Royal Army Medical Corps in France during the 1914-18 war. After demobilisation he joined his uncle's firm, J. W. Darwood & Co., Ltd., in Rangoon, and became an executive director of the Rangoon Electric Tramway & Supply Co. until Rangoon was evacuated in 1942. He returned to Rangoon in 1946 and until the nationalisation of the undertaking in 1953 held what was, in effect, the position of managing director.

Mr. E. W. Jones, who until his retirement in 1956 was manager of the Central Sub-Area of the South Wales Electricity Board at Cardiff, died on 4th June at the age of sixty-seven. Mr. Jones spent more than fifty years in the electricity supply industry. After service at the generating plants of the Coed Ely and Albion Colliery he was appointed in 1918 as manager and chief electrical engineer of the former Mountain Ash municipal undertaking, a position he held for thirty years. He was appointed one of the four Sub-Area managers of the South Wales Board at vesting date and after serving first as manager of the Eastern Sub-Area he was appointed manager of the Central Sub-Area in 1953.

Mr. C. Downie, area distribution engineer and assistant area manager for the South Caledonia Area of the North of Scotland Hydro-Electric Board, has died at the age of forty-four. Mr. Downie joined the Grampian Electricity Supply Co. in 1943 as construction engineer and after nationalisation continued with the North of Scotland Hydro-Electric Board in the same capacity. In 1952 he was appointed distribution engineer and assistant area manager.

Mr. D. G. Evans, sales representative for W. T. Henley's Telegraph Works Co., Ltd., died suddenly on 5th June at the age of fifty-nine. Mr. Evans joined Henley's in 1915 and was well known in the City of London where he had represented Henley's for over thirty years.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £187 10s 0d
Fire Refined 99·70%	ton £186 0s 0d
Fire Refined 99·50%	ton £185 0s 0d
COPPER Tubes ..	lb 1s 9½d
Sheet	ton £211 15s 0d
H.C. wire and strip ..	ton £234 5s 0d
LEAD, English ..	ton £70 15s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £76 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £62 10s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 5¾d
Sheet	ton —
Wire	lb 2s 3¾d
PHOSPHOR BRONZE Wire	lb 3s 6½d
PLATINUM	oz £25 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 22½d—22¾d

Subscriber Trunk Dialling

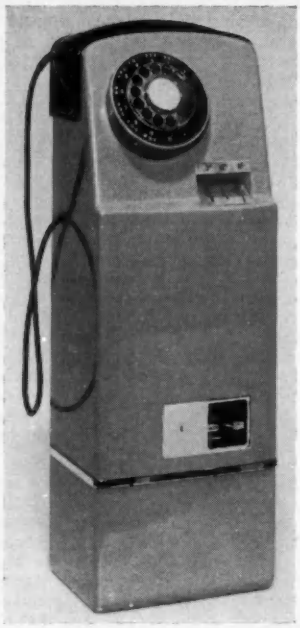
A WHITE PAPER (Cmnd. 436, H.M. Stationery Office, 1s) deals with telephone plans for the next decade and the next steps for full automation of the telephone system are also announced. Subscriber trunk dialling (STD) will allow callers to get through to subscribers in distant parts of the country by dialling special codes before the usual telephone number. Fewer operators will be required and with STD there will be reductions in charges for both local and trunk calls. The White Paper gives a summary of the new charges.

With the new system trunk calls will be charged in "local units." The amount of time bought for a local unit will vary with the distance. Each unit will cost 2d. Instead of a minimum charge for a 3 minute trunk call, callers will pay only for the time they use. Local calls will also be timed and a 2d unit will allow a 3 minute call. There will be no timing signal for subscribers, whose accounts will be simplified since the bill will be in the form of the number of units used for both trunk and local calls. Details of STD previously announced were published in the *Electrical Review* of 22nd November, 1957.

So that these facilities may be given to call office users as well as to private subscribers, Associated Automation, Ltd. (a member of the Elliott-Automation Group), in collaboration with the Post Office, have developed a completely new coin box. The new box has been termed the "pay-on-answer" coin box and provides for connection to be established with the wanted party before any money is inserted by the caller into the coin box. If there is no answer, the telephone handset is simply replaced and no money inserted. If, however, the call is answered the caller gets a signal to insert his money and he can then speak to his correspondent. There are no buttons to press.

The new coin box has slots for threepenny, sixpenny and shilling pieces and a dialled call can be set up with any one of these coins. All coin box calls will be timed in terms of threepenny time-distance units. At night the periods allowed are longer. Each coin inserted is signalled to the automatic exchange equipment by a series of pulses which operate a "time credit" store. When the time paid for has expired, the caller receives a signal to warn him that he must either finish his call or insert additional money.

The rate of decrease of the "time credit" is automatically adjusted at the exchange according to the distance over which the call is connected.



New telephone coin box developed by Associated Automation, Ltd.

PATENTS IN 1957

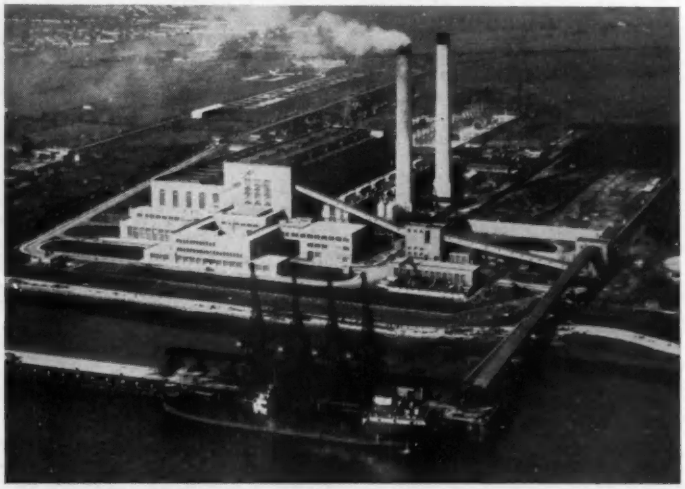
APPLICATIONS for patents during 1957 rose to 40,498 from 39,730 in the preceding year and applications for the registration of designs and trade marks also showed a substantial increase. The number of patents sealed rose from 19,938 to 25,205. This information is contained in the annual report of the Comptroller-General (H.M. Stationery Office, price 1s 6d). In the "electrical art" there was much activity in fuel cells and in cells activated by sea water for life-saving purposes. Interest in electrical methods of measuring and of machine-tool control increased. There was a trend towards "miniaturisation" of components and their modification for use in printed circuits. New types of semi-conductor devices continued to be produced and devices of this kind found increasing use in amplifiers, e.g. in deaf aids, and as switches for telephone systems and computers. Nuclear radiation is becoming widely used in a variety of testing apparatus and supersonic waves are being used in geological research, particularly in oil prospecting.

Group	Class	Main Subject Matter	Primary		Secondary	
			1956	1957	1956	1957
XI	39(2)	Incandescent electric lamps	44	25	12	14
	39(3)	Heating by electricity	129	133	83	83
XIII	29	Refrigeration	86	82	42	21
XXX	104(2)	Railway permanent way	33	31	9	6
	104(3)	Electric railways	4	5	—	1
	105	Railway signals	23	21	5	—
XXXV	35	Dynamo-electric machines	256	222	98	107
	38(2)	Converting electric currents	183	137	69	73
	38(4)	Electric supply systems	287	311	143	134
XXXVI	36	Electric cables	118	79	43	37
	37	Electric tests, semi-conductor devices, resistors, capacitors	368	347	121	126
	38(1)	Electric couplings	170	209	62	66
	41	Electrolysis	103	103	49	38
	53	Electric batteries	97	86	15	9
XXXVII	38(3)	Controlling electric motors	78	59	52	58
	38(5)	Electric switches and relays	441	374	131	133
XXXVIII	13	Bells	12	10	18	10
	40(1)	Electric signalling	217	187	98	12
XXXIX	40(4)	Electric telephones	292	302	66	69
XL(a)	39(1)	Electric discharge tubes	450	501	85	75
	39(4)	Nucleonics	22	43	3	4
XL(b)	40(3)	Telegraphy, photo-electric apparatus, television	317	327	121	122
	40(8)	Electric impedance networks	114	102	63	52
XL(c)	40(5)	Radio systems and sets	152	135	73	76
	40(6)	Electronic discharge tube and semi-conductor circuits	223	190	109	88
	40(7)	Radio navigation, radiolocation, aerials	166	119	68	45

From an appendix we extract the details of complete specifications accepted in 1957 given in the accompanying table. The numbers in the column headed "Primary" indicate the number of specifications classified in respect of the primary feature of the invention, while those under "Subsidiary" are classified in respect of other features.

Arrears of unexamined specifications increased steadily until September; thereafter they were slightly reduced. Following an intensive recruiting drive 58 new examiners joined the staff and the net increase in the examining staff was 53, bringing the total to 392. It is stated that the recruitment of technical staff, especially electronic engineers, remains a matter of utmost concern.

TILBURY POWER STATION



Aerofilm Photo

Aerial view of Tilbury station

LAST Friday Tilbury generating station was officially opened by Col. Sir Francis Whitmore, Bt., K.C.B., C.M.G., H.M. Lieutenant of Essex. The station, which contains six 60 MW turbo-alternators and oil/coal-fired boilers, was described in detail in the *Electrical Review* of 2nd August, 1957. The complete site covers an area of about 200 acres with a river frontage of 2,200ft on the north side of the Thames some three-quarters of a mile below the Tilbury landing stage. The present station occupies the western half of the site adjacent to the river and the layout has been arranged so that a "B" station can be erected on the eastern half of the site.

Each of the six "Etaflo" two-drum John Thompson boilers has a maximum evaporative capacity of 540,000 lb/hr at 950 p.s.i. and 925 deg F at the superheater outlet. No. 6 boiler was commissioned on oil; the other five have been using pulverised coal since they were first put into operation and are being converted to oil during the present year.

Although there is good road and rail access to the site, the station has been designed to use seaborne coal and oil. Full automatic control of the boilers is provided for both coal and oil firing.

The English Electric Co., Ltd., supplied Nos. 1, 2 and 3 turbo-alternators and C. A. Parsons & Co., Ltd., Nos. 4, 5 and 6. Each is a three-cylinder machine with a double-flow exhaust and runs at 3,000 r.p.m. with a maximum continuous rating of 60 MW when the steam conditions at the stop valve are 900 p.s.i. and 900 deg F and the final feed temperature is 385 deg F. Five alternators are hydrogen-cooled and the sixth machine is a water-cooled generator.

The alternators generate at 11·8 kV and the output is fed directly into English Electric 72 MVA, 11·8/132 kV transformers. The operation of the six turbo-alternator/

Turbine hall with six 60 MW sets

At the opening ceremony (left to right): Mr. W. N. C. Clinch, Mr. A. R. Cooper, Sir Christopher Hinton and Col. Sir Francis Whitmore

boiler units is controlled from three separate double-unit control rooms. The main Metropolitan-Vickers 132 kV air-blast switchgear is rated at 3,500 MVA.

Messrs. Merz & McLellan are the main consulting engineers and the architects are Sir Alexander Gibb & Partners.

About 900 guests were present at the official opening when Mr. W. N. C. Clinch, M.I.E.E., Controller, Eastern Division, introduced Col. Sir Francis Whitmore, H.M. Lieutenant, County of Essex, who unveiled a plaque to commemorate the occasion. Sir Francis said he had been intrigued by the multiplicity of intricate equipment and the technicalities of the generation of electric power. A dedicatory prayer was then offered by the Venerable W. N. Welch, M.A., Archdeacon of Southend, and Mr. A. R. Cooper, Regional Director, presented a small plaque to Sir Francis Whitmore.

FURTHER SNOWY MOUNTAINS CONTRACTS

FROM A CORRESPONDENT

SOME historic milestones in the progress of the Snowy Mountains hydro-electric scheme have been passed recently. First there was the announcement of the letting of contracts worth a total of £33 million for three major construction jobs in the Upper Tumut area (two to American firms and one, for the first time, to an Australian organisation). Then the wall of the Adaminaby Dam was finished at a height of about 400ft two years ahead of schedule. But there has been a disappointing failure by British organisations to tender for Snowy Mountains contracts. Sir William Hudson, commissioner of the Snowy Mountains Authority, says that the British Board of Trade had co-operated but despite every inducement British contractors had not tendered.

The Tumut contracts have been awarded to Theiss Bros., Ltd. (Australia), which is to carry out the diversion of the Tooma River into the Tumut River; Utah Australia, Ltd., and Brown & Rootsudamericana, Ltd., a joint American venture, which will construct the T2 underground power station; and the Kaiser-Perini-Morrison-Raymond group, which will be responsible for the diversion of the Murrumbidgee into the Adaminaby reservoir.

The Prime Minister, Mr. Menzies, said the Snowy Mountains Authority had been authorised to accept tenders for the projects despite the issue of a High Court writ by South Australia against the Commonwealth over the scheme. Any significant delay in proceeding with the scheme would add greatly to its cost and postpone its production and earning. As it would be impossible to arrange alternative means of generation in the time available, the result might well be rationing of power.

The T2 power station project included a dam on the Tumut River to impound water discharged from T1 power station. From the dam the water would go by a three-mile tunnel to the T2 power station which would produce 260 MW and was scheduled for operation in 1962. Like the T1 station, now nearing completion, the T2 station would be about 800ft underground. Mr. Menzies said that as the construction of these projects would allow the major works of the Snowy scheme to be more effectively used, the cost of providing for the increased production of electricity would be relatively low. The total cost of the Upper Tumut works now under construction would be about £75 million. The expenditure required to complete the T2 project was equal to about 30 per cent of this amount, and when completed the available electricity would be increased by 80 per cent. Similarly, expenditure required to construct the Tooma and Murrumbidgee diversions was about 25 per cent of the total cost of the Upper Tumut works. However, they would increase available electricity by nearly 90 per cent.

The Adaminaby Dam, just finished, is one of the biggest earth and rock fill dams in the world. It is more than 380ft high and has a base thickness of half a mile. The dam is on the Eucumbene River, a tributary of the Snowy. The Minister for National Development, Senator W. H. Spooner, announcing the completion of the dam by the Kaiser-Walsh-Perini-Raymond group, said that because of the fast rate of construction it had been possible to begin the storage of water behind the dam before its completion. Water in the lake was now 165ft deep against the face of the dam. By November, 1959, sufficient water would be stored to enable a start to be made on the trans-mountain diversion of water of the Tumut River and T1 power station.

Civil Engineers' Dinner

THE annual dinner of the Institution of Civil Engineers was held at the Dorchester Hotel, London, last week with Sir Arthur Whitaker, president, in the chair.

Viscount Bruce of Melbourne, proposing the toast of the Institution, said that human progress was mainly due to the engineer. Even in the field of pure science the engineer provided the apparatus for the scientist and applied the results of scientific research. In reply, Sir Arthur Whitaker described his recent Commonwealth tour and made particular reference to the Snowy Mountains scheme in Australia and the Canadian St. Lawrence Waterway development, the flooding of which should start next month.

Mr. A. E. F. Johnson, member of the Council of the Institution, proposed the toast of the guests and the Hon. Edwin M. Martin (Minister for Economic Affairs, American Embassy) replied.

Meter Testing in London

REDUCTION IN NUMBER OF STATIONS

THE thirty-eight meter testing stations which the London Electricity Board took over on vesting day have now been reduced to six, and when the present plan for rationalising the work of the Meter and Test Branch has been completed the Board's area will be divided into three parts, each served by a single testing station. Two of the new stations, at Fulham and West Ham, have already been in operation for some time, but the establishment of the third at Bexley has to await the allocation of the necessary capital. In the meantime, three smaller stations in South London are being retained and all the testing of d.c. meters has been concentrated in one station at Hackney.

In conjunction with the change-over of the London Electricity Board from a three-tier to a two-tier organisation, the opportunity has been taken of bringing the meter testing stations into the chief engineer's department, and they now report direct to headquarters through the chief meter and test engineer, Mr. H. S. Petch.

One of the advantages of the new stations is that by concentrating staff and equipment in larger units the work is now carried out on a factory rather than a workshop basis. This has not only enabled the number of staff to be reduced but the productivity of the remainder has been increased by the application of work study methods, and valuable instruments are more fully employed. The quality of testing has also been improved by the development of apparatus and techniques that have reduced reliance on the capabilities of individual testers.

Exhibition at Fulham

To show the staff of the Board, from senior engineers to accountants and meter readers, something of what is involved in the work of a test station, Mr. H. H. J. Mockett and his staff at Fulham last week arranged an exhibition of their activities. The meter repair and testing shops were open to inspection and not the least interesting aspect of the many displays of meters and metering schemes was that these carried details of their cost, thus enabling some illuminating comparisons to be made. There were also many examples of the services involving specialised measurement techniques that the station staff can provide to districts in their area, and displays of instruments and time switches by the manufacturers from which the Board purchases its supplies.

Of the two million meters on circuit in the London Board's area, some 850,000 are in the districts served by the Fulham station. At present, these are being repaired, tested and recertified at the rate of about 45,000 a year, and in the same period some 20,000 new meters are tested and certified. The station has the advantage of modern factory and office buildings which were constructed by the Fulham Borough Council Electricity Supply Department immediately after the war.

Disconnected meters from the districts are brought into a store on the ground floor where they are sorted into sizes and makes and given a preliminary check to eliminate those that for reasons of age, condition or policy are not considered worth repairing. After the metal cases have been cleaned and repainted and the Bakelite cases polished, the meters are taken to a workshop on the third floor where they are dismantled, cleaned and the worn parts replaced. One of the advantages of size, previously mentioned, is seen in the method of cleaning. The movements are placed in a series of tanks containing watch-cleaning fluid, circulated under pressure, a dewatering solution and boiling trichlorethylene. In between each tank they are " blown off " and then finally dried in an oven.

The testing of new and reconditioned meters is carried out on the floor below and here again the work has been simplified and speeded up by the use of new methods. The method of connecting the meters on the racks, devised by Mr. Mockett, enables the operation to be completed in a matter of seconds by the tester. It consists of three sprung metal spikes, which carry the supply and are adjustable in two planes. They are inserted into the cable entries, and pressure is then exerted on the top of the meter, to ensure good contact, by two arms which are operated through a scroll wheel from a knob at the front. The electronic system used for checking the meters works with a stroboscope lamp at high loads and a dial counter at low loads. New control panels, designed and built in the station, enable the desired currents to be obtained by depressing push-buttons.

Prototype Equipment

A meter unit for installation on the external landings of L.C.C. flats that have floor warming has been produced in conjunction with the chief engineer's department of the L.C.C. and consists of two 40 A meters and a time switch in a metal box with two doors. The outer door, which can be opened by the consumer and meter reader, enables the meter readings and time switch settings to be observed; the inner door is opened only when the meter or time switch has to be removed.

Of special interest among the equipment being shown by manufacturers was a prototype billing meter by Ferranti, Ltd. With this meter the consumer inserts a card into a slot and by turning a handle prints on the card the units registered. The card is arranged with sealed interleaved carbon paper so that no deposit is left on the raised printing digits carried on the periphery of cyclometer wheels. The wheels are driven by a spring which is wound by the printing handle and released by the meter mechanism through a dead centre escapement. This ensures that the printing wheels are exactly in step with the meter dials, and that no load is placed on the meter mechanism.

A prototype time switch for domestic use, which can be plugged into a lighting point or socket outlet, was shown by Venner, Ltd., who also had a press-button unit for use with electric fires in station waiting rooms. The Horstmann " Timestat " is operated by a synchronous motor and has a supplementary spring drive mechanism so that the unit will continue to operate at the correct times even though there have been periods when the power has been cut off. Smith Meters, Aron, and Sangamo Weston had examples of American type outdoor meters with domed glass covers. The last-named also showed their model S200 watt-hour meter which contains several novel departures in design. In particular, the train has been made integral with the grid casting, which carries all the moving parts and can be removed by releasing three screws.

Synchronous Motors

Survey of Characteristics and Applications

By D. D. STEPHEN, B.Sc., A.M.I.Mech.E., A.M.I.E.E., Assoc.A.I.E.E.*

THE principles of operation of synchronous machines have been known for many years, but for a long time little interest was taken in their use as motors. When a synchronous motor was occasionally required an alternator design was normally used and the starting characteristics were, consequently, very poor. Induction motors, however, were used extensively for all applications and considerable development was carried out to make them suitable for purposes requiring special starting characteristics. The ability of synchronous motors to operate at unity or a leading power factor was, in fact, the only significant feature which led to their use in preference to induction motors, and their inferior starting characteristics

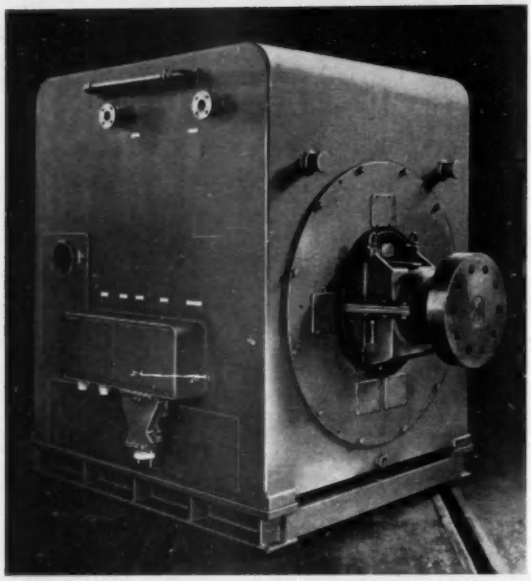


Fig. 1.—Closed-air-circuit water-cooled salient-pole synchronous induction motor rated at 800 h.p., 0·9 leading power factor, 750 r.p.m., 2,300 V

usually restricted their use to low starting torque applications such as motor-generator sets. The position, however, has changed radically in recent years, and, although the higher initial cost of a synchronous motor compared with an induction motor usually precludes its use for low powers, say, below about 100 h.p., for higher powers synchronous motors are now being used to an increasing extent where one or more of the following characteristics are required.

Several alternative types of synchronous motor are now available and their starting characteristics have been improved so that they compare with those of induction motors. Synchronous motors are now being built for direct-on-line starting taking less than 3½ times full-load current at starting and other types can provide starting torques as high as those provided by slip-ring induction motors.

Induction motors always operate at a lagging power factor and consequently a synchronous motor of equal output and operating at unity power factor will have a smaller input kVA rating. This means that a synchronous motor can have lower losses and a higher efficiency. It can also be a smaller machine physically, which is advantageous from the point of view of foundations and building requirements.

The lower input kVA of the synchronous motor is particularly advantageous in applications requiring large power outputs. The running power costs are appreciably lower when the motor operates at unity power factor and the cost of providing the supply, being dependent on the kVA, is also lower. With such installations the total cost of motor, control, and supply equipment frequently indicates that the synchronous motor is the more economic proposition. Synchronous motors are normally used when very large outputs are required since factors such as slip-ring rating, which impose limits on the possible size of induction motors, do not apply to synchronous machines.

Synchronous motors have a much larger radial air gap than induction motors and this enables them to resist unbalanced magnetic forces more easily. They are consequently preferred for mechanical constructions in which appreciable shaft deflections can occur, for example, for use as overhung compressor motors.

Applications

Banbury mixers are used to mix the raw ingredients required for the manufacture of rubber and are usually closed machines. One of the ingredients is "carbon-black," which is a highly conductive powder in a fine state of division. It will penetrate any cracks or flaws in insulation and can form a conducting path which may cause tracking or a flashover. For this reason open-type motors

* B.T.H. Plant Engineering Department.

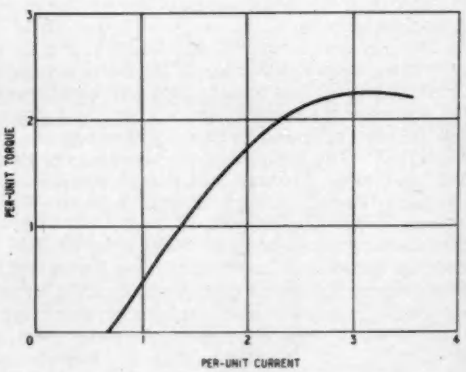


Fig. 2.—Typical starting torque/starting current characteristic of a salient-pole synchronous induction motor

should not be used for this drive and the larger machines are normally of the closed-air-circuit water-cooled type. Banbury mixers, due to the nature of their charge, may encounter high torques during normal mixing or when starting against a "jam," and motors capable of exerting high torques are required for driving them. These torque requirements are easily satisfied by the salient-pole synchronous induction motor which can economically provide a starting torque of 250 per cent full-load torque and an inherent synchronous pull-out torque of the same order. Such a motor also has the advantages of operation at constant speed (which simplifies the control of mixing), good efficiency, and operation at unity or a leading power factor. Fig. 1 shows a completely closed machine of this type designed specifically for this duty. The water coolers are inside the outer frame and all covers and the bearings are sealed to prevent the ingress of carbon-black. This motor, driving through a gear box, operates at 750 r.p.m., which is desirable as it enables the motor to be self-ventilated and is also about the optimum speed for high efficiency and low cost. Direct-drive low-speed motors of this same type have also been used for driving Banbury mixers, but these require separate ventilating fans when closed-air-circuit ventilation is used.

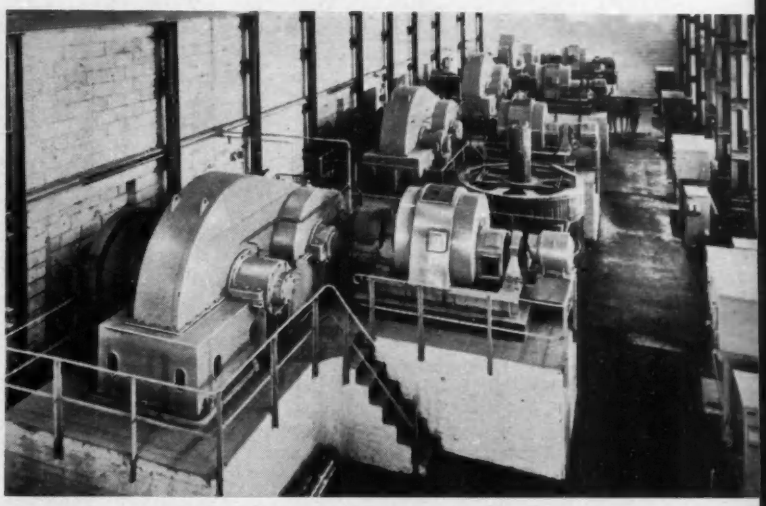


Fig. 3.—Four salient-pole synchronous induction motors each rated at 1,200 h.p., 0·95 leading power factor, 750 r.p.m., 3,300 V, driving cement mills

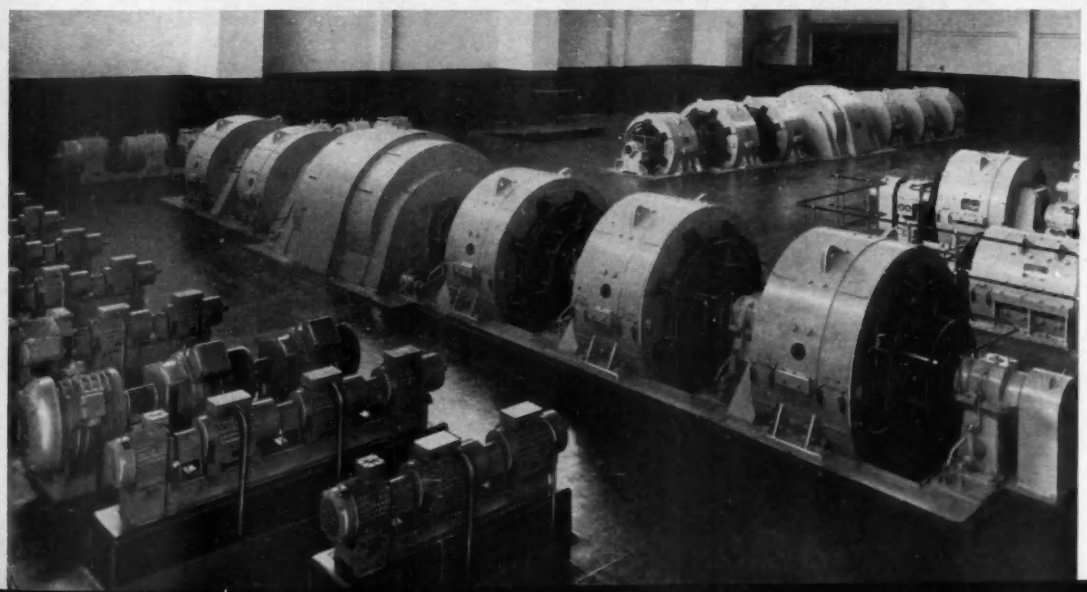
Cement grinding mills operate continuously on full load for long periods and, as their driving motors consume a considerable proportion of the total electrical power demand of the whole plant, and the cost of power forms an appreciable part of the cost of the cement produced, the ability of the driving motors to operate with high efficiency and provide power factor improvement can result in appreciable economy. Grinding mills need a high torque, of the order of full-load torque, during starting. All these requirements can be satisfied by the salient-pole synchronous induction motor and for this reason it is being used to an increasing extent for this particular application. Fig. 2 shows the relationship between the starting torque and starting current of a typical salient-pole synchronous induction motor used to drive a cement mill.

Mills operate at a low speed and are driven through some form of gear by a medium-speed motor. The motor speed can thus be selected to obtain maximum efficiency. Motors such as those shown in Fig. 3 can attain a full-load efficiency of 97 per cent.

Centrifugal compressors operate at high speeds and are usually driven through gear boxes by high-speed motors. They operate on load for long periods and efficiency is often very important. They generally require powers between 1,000 and 10,000 h.p., and occasionally above this value, and synchronous motors are normally used for this duty. The solid-pole motor is excellent for operation at four-pole speeds (1,500 r.p.m. on a 50 c/s supply), while the squirrel-cage type operating at six-pole speed (1,000 r.p.m. on a 50 c/s supply) is more suitable for outputs above 10,000 h.p. and can have very high efficiencies, rising to a figure of the order of 98·5 per cent at 30,000 h.p.

Centrifugal compressors are usually unloaded during starting and the torque required is normally less than 50 per cent full-load torque. Reduced voltage starting can thus be used with either of the above types of motor and the starting current kept to quite a low value. Alterna-

Fig. 4.—Two motor-generator sets driven by squirrel-cage synchronous motors each rated at 11,600 h.p., unity p.f., 750 r.p.m., 11 kV



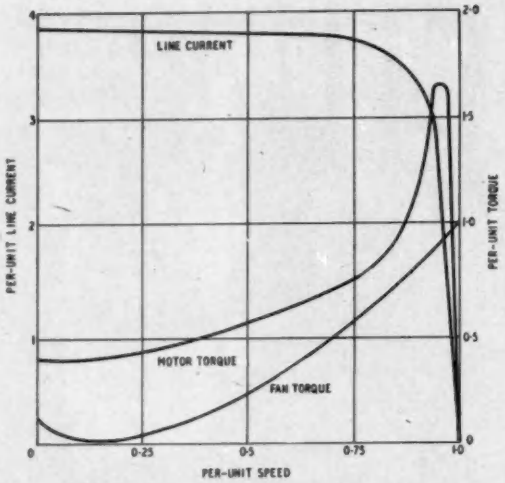


Fig. 5.—Typical starting torque/speed characteristics of a ventilating fan and a squirrel-cage synchronous motor

tively, direct-on-line starting can be used provided the starting current taken by the motor does not have adverse effects on the system.

Motor-generator sets.—Synchronous motors have been used to drive all varieties of m.g. sets for many years and are the most common type for this drive for powers above a few hundred horse-power except when low first cost is the most important factor in determining the type of driving motor to be used. All motor-generator set motors can be unloaded for starting and the starting current taken by a squirrel-cage or solid-pole synchronous motor can, consequently, be kept to a reasonably low value using reduced voltage starting or its equivalent. Reactor starting is the simplest and most convenient form normally used and motor-generator sets can usually be started satisfactorily while taking a current of about $1\frac{1}{4}$ to $1\frac{3}{4}$ times full-load current. When the starting current must be kept lower than this, then auto-transformer or pony motor starting must be used, but these are slightly more complicated and require more auxiliary equipment. Alternatively, a synchronous induction motor or a salient-pole synchronous induction motor can be used, but these usually take a starting current of the order of the full-load current. The squirrel-cage synchronous driving motors shown in Fig. 4 are designed for starting direct-on-line (taking less than four times full-load current) when the normal reactor starting is not used.

The solid-pole motor is ideal for operation at high speeds, while at lower speeds the squirrel-cage synchronous motor can be built for the greatest powers yet required. The speed of a motor-generator set is fixed by the generator design requirements.

Mine ventilating fans operate continuously on load for very long periods, often without a shut-down for several months at a time. It is not convenient to " unload " mine fans for starting and their torque-speed curve is of the shape shown in Fig. 5. With all fan drives except the smallest, the power factor and efficiency of the motor are of considerable importance due to the continuous operation at full load, and synchronous motors invariably prove to be the most economic, particularly with the larger outputs. Squirrel-cage synchronous motors can be built with suitable starting characteristics (see Fig. 5), but the starting currents taken are high and may cause difficulties with protective gear. The synchronous induction motor and

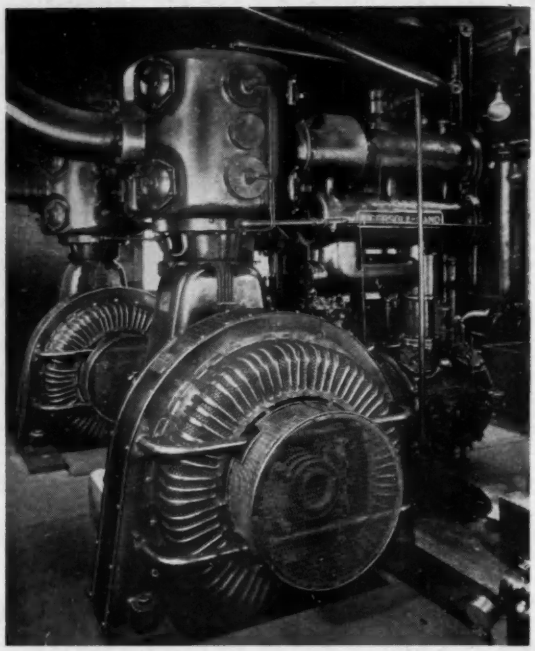


Fig. 6.—Salient-pole synchronous induction motors rated at 151 h.p., 0·9 leading p.f., 375 r.p.m., 440 V, mounted directly on air compressor crankshafts

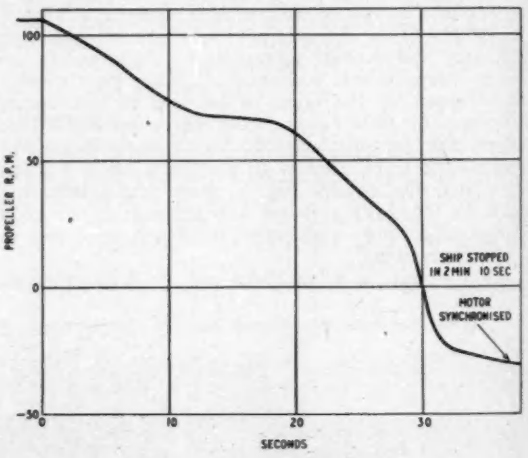


Fig. 7.—Results of full speed reversal test on squirrel-cage synchronous ship-propulsion motors

salient-pole synchronous induction motor can provide adequate starting torque with a much lower value of starting current. The salient-pole synchronous induction motor can be designed for efficiencies as high as the squirrel-cage synchronous motor and higher than the synchronous induction motor, particularly in larger sizes, and is consequently ideal for this application. The ability of this type of motor to operate at reduced speed using the starting resistor as a slip regulator often proves useful as some mine ventilating fans are required to run at about quarter speed in an emergency.

Ventilating fans run at fairly low speeds and driving

motors can be direct-coupled or can drive through some speed-reducing device such as a rope drive or a gear box. The higher speed motors can be built with higher efficiencies and are now being used to an increasing extent. These comments also apply to fans used for purposes other than mine ventilation and in fact salient-pole synchronous induction motors are now being considered to an increasing extent for sinter fan drives.

Pumps.—Synchronous motors are used for driving all types of pumps mainly because of their ability to operate at unity or a leading power factor. The wide range of synchronous speeds which are attainable enables motors to be direct-coupled to high-, medium- or low-speed pumps.

A large number of pumps are required for dewatering mines in South Africa and centrifugal pumps operating at 1,500 r.p.m. and installed down the shaft are the most numerous. The solid-pole synchronous motor either direct-on-line or reactor started is ideal for this drive as its torque-speed characteristic matches the pump characteristic well and its robust construction makes it suitable for high-speed operation. As these motors have to be lowered down the shaft, the small size of synchronous motors is an advantage and operation at a high efficiency is desirable as it reduces the amount of heat dissipated underground and thus eases the problem of mine ventilation.

Reciprocating ram pumps are used for supplying hydraulic systems such as are used in steel mills and they require fairly high starting torques. The salient-pole synchronous induction motor can provide the starting torque quite easily and has been used for many such drives where a good power factor is desirable.

Pumps used for drainage or normal water pumping often operate at medium speeds and can usually be unloaded at starting. Squirrel-cage synchronous motors started direct-on-line are very suitable for driving such pumps. When the starting current taken by such motors is too high or when unloading is not convenient, the synchronous induction or salient-pole synchronous induction motor provides a suitable drive. All these types of motor can be built conveniently as vertical units for mounting above the pumps.

Pumped storage schemes are now proving economic on some power systems which have to supply severe peak loads and synchronous motor driven pumps are used since the units are usually rated at more than 40,000 or 50,000 h.p. Frequently, the motor is capable of operating as an alternator driven by the pump operating in reverse as a hydraulic turbine or, alternatively, by a separate turbine on the same shaft as the pump. The hydraulic conditions have, as yet, always been such that the squirrel-cage synchronous motor provides satisfactory starting characteristics and this is convenient as this type of machine can be designed to withstand the overspeeds which can occur with hydraulic turbine drives.

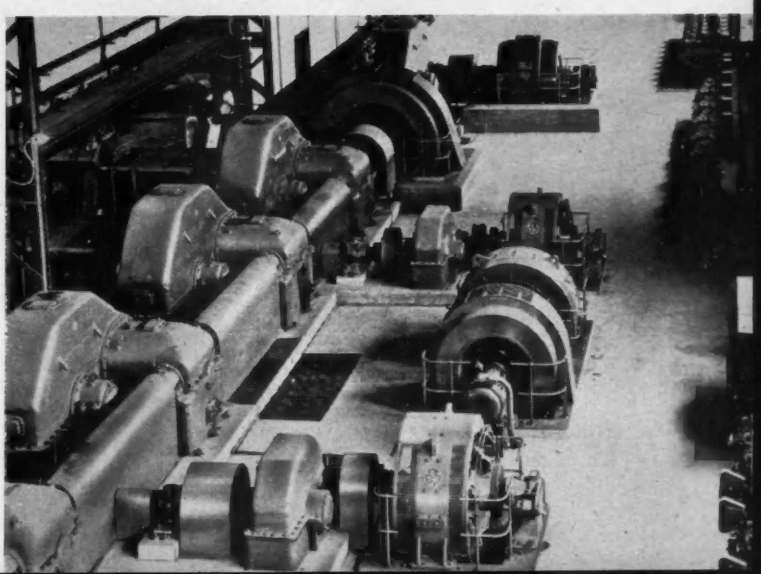
Reciprocating compressor drives.—When the power required exceeds about 100 h.p., it is convenient to use a direct-drive synchronous motor which operates at unity or a leading power factor. A squirrel-cage synchronous motor can be used and it can be started direct-on-line, taking about 3½ times full-load current when starting an unloaded air compressor. When starting a loaded compressor the current will be somewhat higher; for example, a motor starting a loaded ammonia compressor against 130 per cent full-load torque takes less than six times full-load current during starting. Alternatively, the synchronous induction or salient-pole synchronous induction motor could provide this high value of torque while taking less than twice full-load current. Because of its long air gap the synchronous motor is ideal for mounting direct on the compressor crankshaft (see Fig. 6). No motor bearings are required, which gives a compact and cheap arrangement together with all the advantages of a synchronous drive.

The mixture in open **rubber mills** is dealt with manually and it is possible for an operator to be drawn into the mill. To prevent serious injury in the event of such an occurrence, it is customary to provide some effective braking on the mill. This can be initiated by the operator if he should be drawn into the mill and it must stop the mill in a fraction of a revolution. Synchronous motors with correctly designed dynamic braking can give sufficiently rapid braking quite simply, and this feature, in addition to the more usual benefits provided, accounts for their increased use for this drive. To enable a mill which is jammed to be started, a high starting torque of the order of 200 to 250 per cent of full-load torque is of considerable advantage and the salient-pole synchronous induction motor can provide this in addition to the other desirable features.

Some rubber mills are driven by squirrel-cage synchronous motors, but these must be started direct-on-line to give a reasonable starting torque and the starting current is usually about six times full-load current to give 125 per cent of full-load torque starting torque.

Electric ship propulsion drives have been used for many years. The propulsion motors are normally connected to the screw shafts directly, although gears are sometimes interposed, and are installed as near to the stern of the vessel as possible while the prime mover driven generators can be placed in any other convenient position. Synchronous propulsion motors are invariably used for large powers as they can operate at unity power factor thus requiring the minimum sizes of generators, motor, cables, etc., and also giving maximum efficiency. Speed control is obtained by reducing the speed of the prime mover, which may be a steam turbine, a gas turbine or a diesel engine, or multiple units of these, and maintaining synchronism between the generators and the motors. By removing excitation from the motor it will operate as an induction motor at an even lower speed. When the supply

Fig. 8.—4,500 h.p., 0·9 leading p.f., 300 r.p.m., 11 kV salient-pole synchronous induction motor driving a rolling mill through a train of gears

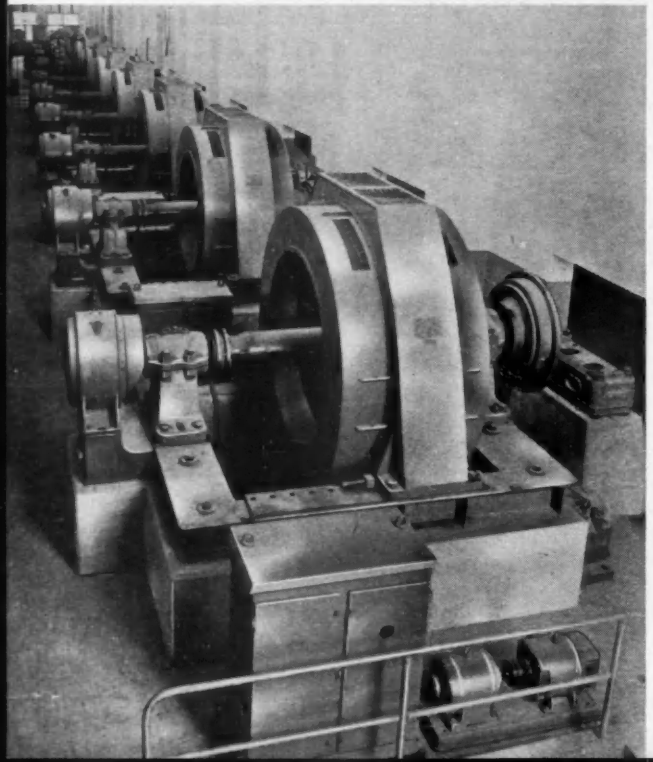


to the motor is interrupted and reconnected with reversed phase sequence the motor will reverse the screw and, when up to synchronous speed in the reverse direction, it can be synchronised. Raising the prime mover speed can then increase the screw speed to full speed in reverse. This complete full speed reversal can be carried out within a few minutes without requiring any reversal of the prime mover, which is most convenient. Fig. 7 gives the result of a full speed reversal test from 18·5 knots of a 19,000 ton liner and shows that the screws were stopped in 30 sec, the motors were running in reverse and synchronised with the turbo-alternators in 37 sec and the vessel was brought to a standstill in 130 sec. The latest example of this drive consists of a twin-screw vessel to be driven by two synchronous motors, each rated at 42,500 h.p. at 147 r.p.m. and having a full-load efficiency exceeding 98 per cent.

A few **steel mills** are suitable for constant speed operation and for such drives synchronous motors are very desirable as they can improve the overall power factor of the complete mill system enough to show a saving in power costs. Rolling mills require a varying torque and the peak value may be two or three times the mean value. Synchronous motors can be built with inherent pull-out torques of this amount, or alternatively they can be built with a much lower value of inherent pull-out torque and be provided with an automatic excitation control scheme which enables the motor to give any peak torque required by the mill. This latter arrangement has two advantages. The motor can be made smaller and therefore cheaper than one with a high value of inherent pull-out torque and the power factor taken by the motor can be kept to unity automatically throughout the rolling cycle, thus reducing the kVA demand and kWh consumed to the minimum; alternatively, the kVAr can be kept constant automatically thus providing a fixed amount of power factor improvement.

Fig. 8 shows a typical steel rolling mill installation which incorporates a 2,180 h.p. squirrel-cage synchronous motor driving a motor-generator set and a 4,500 h.p. salient-pole synchronous induction motor driving a mill line through gears.

Fig. 9.—Seven squirrel-cage synchronous motors each rated at 2,500 h.p., unity p.f., 300 r.p.m., 6·6 kV, driving wood pulp grinders



Wind tunnels need some form of fan or compressor to move large quantities of air at high speeds and the power required for such drives is increasing rapidly as more elaborate tunnels are designed. To handle very large powers it is necessary to design the compressor for direct connection to the motor as gear drives are impracticable. To design motors for these powers presents great mechanical problems as there are limits on the speed and power outputs when using normal constructional materials; it is often convenient to interconnect one or more motors for such a drive.

At present 216,000 h.p. on a single shaft is the biggest unit in operation in the United States and this drive consists of two synchronous motors, each rated at 83,000 h.p., and two slip-ring induction motors, each of 25,000 h.p., the latter being used for starting the set. The largest drive in this country is rated at 80,000 h.p. and was supplied by the English Electric Co., Ltd., for the 8ft by 8ft high-speed wind tunnel at the Royal Aircraft Establishment, Bedford. The drive consists of a 68,000 h.p. synchronous motor coupled, through gears, to two 6,000 h.p. d.c. motors which are employed for starting, using a Ward-Leonard motor-generator set. The synchronous motor can be connected to the grid or can be supplied from local variable-frequency gas turbine driven generators.

Wood Pulp Grinders.—One of the first processes in the manufacture of paper is the reduction of the logs of timber to loose fibres. This is done by pressing the logs against a rotating grindstone and various types of machine are used for this purpose, each differing in the feeding arrangements. The grinders can always be unloaded for starting by relieving the pressure forcing the logs against the stone. The stones are usually rotated at a constant speed of about 250 r.p.m. and have an appreciable amount of inertia. Originally, motors of about 1,000 h.p. were required to drive grinders but the modern tendency is to use larger stones and motors of 4,000 or 5,000 h.p.

Grinder motors can form an appreciable part of the total power demand of the mill and the use of synchronous machines often gives considerable saving in power charges because of the improved power factor of the total load. Most modern grinders are driven by synchronous motors, particularly those requiring the larger powers, but there are two different mill conditions, each of which calls for the use of a different type of motor. Some mills have a large number of grinders installed in a single grinder house and the total load on the feeder is considerable. Starting a single motor direct-on-line then has a negligible effect on the supply and the use of a squirrel-cage synchronous motor started in this way provides a cheap and simple drive. Such grinder motors can be designed for direct connection to grinders and can provide about 50 per cent of full-load torque during starting while taking only about 3½ to 4 times full-load current at starting. Other mills, however, only have one or two grinders installed and may either be supplied from their own generating plant or have a relatively weak power supply and direct-on-line starting cannot then be used. The most suitable motor to use for driving such grinders is the salient-pole synchronous induction motor which can start with a current only slightly greater than full-load current. This type of motor is capable of providing a starting torque as great as 250 per cent full-load torque and can be used to start against a jam if necessary and so obviate the unloading of a jammed grinder. It can also be designed to have the same order of efficiency as the squirrel-cage synchronous motor which is much higher than that of

the synchronous induction motor, and there is no restriction on the output for which it can be built. Fig. 9 shows a line of seven 2,500 h.p. 6·6 kV squirrel-cage synchronous motors for driving grinders; their direct-on-line starting current is less than 3¾ times full-load current.

The applications described above have been chosen as their particular requirements have been found to be matched by the characteristics of some form of synchronous motor in one or more ways, but, of course, synchronous motors are also used for other applications. The examples considered, however, show that the design of synchronous motors has developed rapidly in the last few years and in a different manner from other forms of a.c. motors. The main development has been in the combined synchronous and starting characteristic together with special mechanical constructions, and all these have been matched to the requirements of particular drives for which they are most suited.

£14 MILLION SCOTTISH SCHEME

FIVE DAMS AND FOUR GENERATING STATIONS

A HYDRO-ELECTRIC scheme which the North of Scotland Hydro-Electric Board has proposed should be built in the Strathfarrar-Kilmorack area has been confirmed by the Secretary of State for Scotland. The scheme covers a catchment area of 350 square miles in the counties of Inverness and Ross and Cromarty and will involve the building of five dams and four generating stations for the production of 261 million kWh annually. The estimated cost is £14¼ million.

Loch Monar will be enlarged by main and subsidiary dams to form a reservoir and water will be taken by a tunnel to a generating station near Deanie at the western end of Loch Beannacharan. From Loch Beannacharan, the level of which will be raised by a dam, water will be led by tunnel to the Culligran generating station on the bank of the River Farrar downstream of the Culligran Falls. The level of the River Beauly will be raised by a dam north of Crask of Aigas. A generating station will be built into the dam and water from the station will discharge into the headpond formed by a dam at Kilmorack, lower down the River Beauly. A generating station will also be built into the lower dam at Kilmorack.

The Amenity Committee set up under the Hydro-Electric Development (Scotland) Act, 1943, recommended that the site proposed for the upper dam near Crask of Aigas should be moved upstream in order to preserve unique island rock formations in the River Beauly. The Board has agreed to adopt this recommendation provided that the detailed site investigations show that the extra costs do not seriously affect the economics of the scheme. The Board was unable to accept a modified scheme suggested by the Fisheries Committee, and the Committee then made detailed recommendations which they considered essential for the protection of fisheries in the rivers affected. The Board has since reviewed the proposals in the scheme for compensation water for fisheries and has agreed to adopt generally these recommendations.

Nine objections were lodged against the scheme and three were subsequently withdrawn. A public inquiry was held last December by Mr. R. S. Johnston, Q.C., who, in his report to the Secretary of State, recommended that the scheme should be confirmed as amended by the Board to give effect to the Fisheries Committee's recommendations.

The Strathfarrar scheme is an important part of the North of Scotland Board's programme which is designed not only to meet the increased demand for electricity that is expected in the Board's area but also to provide peak supplies of electricity to the South of Scotland Electricity Board. The cost of generation is estimated to be 0·75d/kWh. The scheme is designed for an average annual load factor of 29 per cent, which is approximately equal to the average annual load factor of the North of Scotland Board's system. New steam generating stations and nuclear stations are most economically run at much higher load factors, and the cost of production at a load factor of 29 per cent at a modern steam station would be 1·08d and at a nuclear station 1·63d.

A White Paper on the scheme has been published and is available from H.M. Stationery Office, Edinburgh, price 1s.

Auckland Electrical Exhibition

FIFTY years ago electricity supply was commenced in the city of Auckland, New Zealand. The Auckland Electric Power Board desired to celebrate the golden jubilee this year but was prevented by various circumstances. It has arranged, however, to organise an electrical exhibition round about Easter next year in conjunction with the annual show of the Auckland Manufacturers' and Agricultural and Pastoral Associations, which this year was attended by over 245,000 people.

The Board has secured the support of a number of New Zealand organisations, including the Institute of Engineers, the Institute of Electricians, the Electrical Contractors' and Wholesalers' Associations, the State Hydro-Electric Department, the Department of Scientific and Industrial Research, the Auckland University School of Engineering, and the Auckland Manufacturers' Association. In addition, representatives of overseas Governments and electrical interests have promised their support. The Board will meet the rental of a modern show building and plans are already in hand.

Among the Board's proposals is that there shall be a "Historical Court" in which electrical progress over the years will be depicted. We are informed that the British Electrical and Allied Manufacturers' Association has generously agreed to sponsor this Court and arrange a composite display. It is hoped that local organisations will combine their efforts and also stage a display in this Court. In addition space will be available in the building for individual organisations' exhibits.

It is hoped that the Department of Scientific and Industrial Research, perhaps in conjunction with the Institute of Electrical Engineers, the University and similar organisations will be able to provide a court in which scientific experiments will be demonstrated. Other features will be exhibits illustrating nuclear energy and electronic progress and a generation section including hydro-electric development.

Applications for space in the building have to be in the organisers' hands by 31st July. Application forms and further details can be obtained from Messrs. Preece, Cardew & Rider, 8, Queen Anne's Gate, Westminster, S.W.1.

The opening ceremony in the Fondation Berthelot

LARGE POWER SYSTEMS

Biennial C.I.G.R.E. Meeting Opens in Paris

THE seventeenth International Conference on Large Electric Networks, which is more generally known as C.I.G.R.E., opened in the Fondation Berthelot in Paris in the afternoon of 4th June and concludes to-morrow (Saturday). The opening ceremony was to have been presided over by the French Minister of Industry, but he was unable to attend owing to pressure of Government business and the Minister of Transport officiated in his place.

Sir Vincent de Ferranti (left) is chairman and Mr. R. A. McMahon (right) secretary of the British National Committee

After the Minister had expressed his interest in the conference, Mr. G. Silva (president, C.I.G.R.E.) welcomed the delegates, who numbered some 1,700 and represented 45 countries. He explained the significance of the conference and the scope of the forthcoming proceedings. Two short speeches were then delivered by Messrs. C. B. Blydt (Norway) and W. Szumilin (Poland) on behalf of the English-speaking and French-speaking delegates respectively. The opening meeting was rounded off by Monsieur Ailleret (Electricité de France) who delivered a short, but interesting, illustrated lecture on the 380 kV European power networks.

Transformers

Technical sessions opened with discussions of papers sponsored by the committee for transformer studies, which was presided over by E. T. Norris (Ferranti). The first (H. Nolen, Netherlands) dealt with different systems of large separate and parallel-operated units. In most countries, the author said, the generator took care of the entire voltage regulation, the step-up transformers having no on-load tap-changers. In Great Britain and Germany, however, the generator alone was often regulated within close limits and its transformer had hand-electrically-controlled tap-changing; the general tendency seemed towards a more extensive use of this method. In Europe most new large high-voltage distribution transformers were equipped with tap-changers, whereas in the U.S.A. the proportion was under half. Automatic voltage regulation was being increasingly employed. Where regulating transformers had to be paralleled, additional resistance should be inserted between them to avoid excessive circulating currents. In the second paper (E. S. Tenkvist, Sweden) it was stated that short-circuit currents in large transformers were usually less than expected from calculations based on the worst conditions.

In the third report special problems and trends in large transformers were considered by R. Langlois-Berthelot (France), who referred to transport conditions in various countries as limiting weight and dimensions. The weight of a transformer varied approximately as the 0·75 power of its rating. For auto-transformers the apparent rating must be reduced by a factor $\frac{\text{h.v.} - \text{m.v.}}{\text{h.v.}}$ to give the actual rating (which for a 380/225 kV unit was 0·42), though in practice for several reasons (e.g. the inclusion of a tertiary winding and on-load tap-changing) the figure might become 0·65. Cold-rolled steel was being increasingly used; specific losses of 1·22 W/kg and under at 15,000 gauss were obtainable. With this steel flux densities could be raised from 14,500 gauss to 16,500 and 17,000 gauss, and space factor from 90 to 95; thus within the same dimensions ratings could be 25 per cent greater and iron losses 20 per cent less. Forced cooling of the largest units by pump (oil-immersed motor) and external cooler (water or air) allowed a substantial reduction in oil and in overall weight and dimensions.

Comparison of designs of British 275 kV transformers were drawn by W. Casson and G. B. Harper (Central Electricity Generating Board), who announced that of the 94 units ordered up to September last 42 were now in or ready for service. All transmission transformers were provided with forced-oil air-blast cooling, 50 per cent of

the continuous maximum rating being obtainable with natural cooling. Double-wound tranformers so far ordered were rated at 130 MVA, 275/66 kV star-star connected with delta-stabilising winding of one-third capacity of the untapped main winding. Impedance was 20 per cent with on-load tapping of ±15 per cent.

Auto-transformers for 275/132 kV interconnection had a throughput rating of 120 and 180 MVA with tertiary windings as for double-wound units but with terminals brought out. Impedance was 15 per cent with on-load tapping of ±15 per cent based on 132 kV. Generator transformers were rated at 106, 125 and 210 MW corresponding to machine ratings of 100, 120 and 200 MW. They were connected in delta-star with impedances of 19·5, 17·5 and 15 per cent and an on-load tapping range of ±10 per cent.

Designs adopted for 275 kV windings were either of the disc-coil or multi-layer concentric types. The first tended to a more conventional design, while the second offered inherent advantages as regards voltage grading, but the relative values of the various factors were only marginal.

As far as possible the existing policy of installing three-phase transformers would be continued in future developments, subject to transport restrictions in regard to weight and dimensions. Transformers now installed had cores of hot-rolled steel worked at a flux density of 13,500 lines per sq cm. This limit would be raised in the near future to 16,000 when adequate supplies of cold-reduced grain-oriented strip become available, as anticipated. The effect would be that a 180 MVA auto-transformer would weigh only slightly more than a present 120 MVA unit. Auto-transformers with a throughput rating of 240 MVA were a future probability.

For the 275 MW and 550 MW generating sets on order transformers of 310 and 620 MVA would be required. In the first case the omission of regulating windings was under consideration, the voltage being adjusted by a separate booster. For 550 MW sets either banked 310 MVA three-phase transformers or single-phase transformers forming a 620 MVA unit were possible alternatives, though the latter would entail undesirable complications. Consideration was being given to the experimental operation at 380 kV of certain sections of the 275 kV system. Tests on sample transformer windings had indicated that suitable designs were available for an impulse level of 1,425 kVp associated with a power-frequency test voltage of 630 kV r.m.s.

Mr. E. T. Norris

Mr. W. Casson

Mr. G. B. Harper

Circuit-Breakers

The committee on circuit-breakers revealed, through H. Meyer, the difficulties found owing to the restriking voltages on systems being more complex than in a test circuit exhibiting one natural frequency only. In the former instance the initial rate of rise of restriking voltage was often rapid up to a small amplitude, the maximum value thereafter being attained with a greatly reduced wavefront. As the point on the voltage curve that determined the capacity of a given circuit-breaker could not be foreseen, two alternatives were open. A choice could be based either on the low-frequency component of the restriking voltage corresponding to its maximum amplitude, thus risking failure of a breaker sensitive to

Some of the delegates at the opening ceremony

Mr. D. F. Amer

Mr. A. F. B. Young

Mr. W. N. Kilner

Mr. V. Easton

Mr. F. J. Fisher

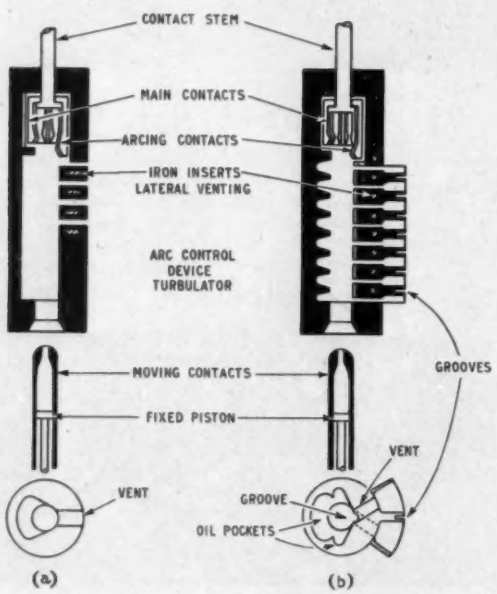
Dr. E. Friedlander

the high-frequency component in a complex circuit, or else solely on the initial rate of rise of restriking voltage which generally resulted in an over-dimensioned and thus more expensive breaker.

A proposal was described by A. Hockrainer (Germany) which envisaged characterising the restriking voltage by taking an additional point on the curve at the peak value of the first voltage maximum. This proposal would necessitate indication of four parameters on a voltage-time basis.

Results of re-testing single-break oil circuit-breakers up to 132 kV and 2,500 MVA at a new research station (described at C.I.G.R.E. in 1954 by Christie and Leyburn) were given by D. F. Amer and A. F. B. Young (Reyrolle), who also discussed the measuring and photographic techniques applied. Their conclusion was that short-circuit tests must be made at full current and full recovery voltage, the latter being essential for determining electric strength near the gas bubble and the consequent effect on arc re-ignition. Particulars were given of a new arc control device (turbulator) shown in Fig. 1. The arc was drawn in front of the lateral vents so as to be extinguished by the oil and gas leaving the turbulator; oil injected into the turbulator during the opening stroke assisted extinction at low currents. A feature of the new turbulator was the trapping of the oil in pockets so that

Fig. 1.—Comparison between (a) earlier and (b) later designs of turbulator with lateral venting



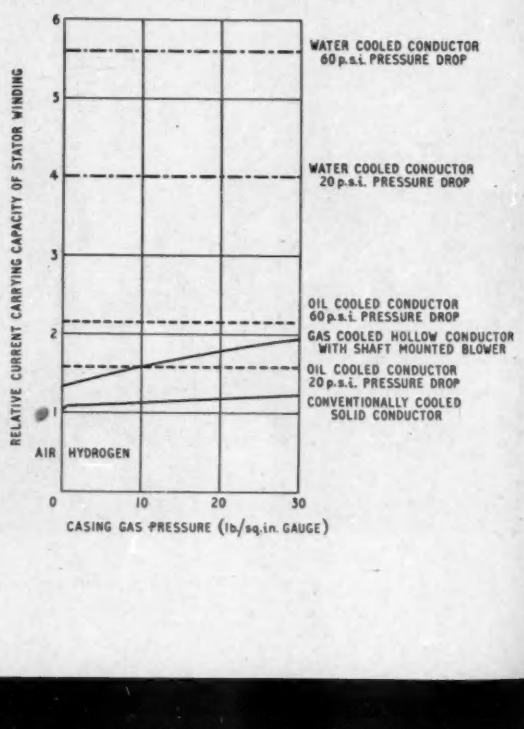
any tendency of the arc to move was counteracted by increased generation of gas.

Alternators

The inner cooling of stator windings of alternators by water in direct contact with the copper was the subject of a paper by W. N. Kilner (Metropolitan-Vickers). The main purpose was to keep the weight of the stator, the heaviest single component of a generating set of 200 MW and over, within the 150 ton limit and within the dimensions imposed by the railways in Great Britain. The high specific heat of water and its low viscosity required small circulating pressures and pumping powers, while current-carrying capacity for a given space was appreciably greater than was provided by alternative cooling materials (see Fig. 2). Copper loss due to reduction of conductor area might reduce efficiency by 2 per cent for a 200 MW machine, but the core diameter would be 6in less and the weight 21·5 tons less. An air-ventilated 30 MW unit employing this principle had been in satisfactory commercial service for two years, but the large machines under construction would contain hydrogen at 30 lb/sq in. Water cooling of the terminals also would decrease their size and enable them to be more easily accommodated. The use of boiler feed as coolant of the stator return water would recover some of the heat lost in the winding.

For checking at a manufacturer's works whether any alternator frame with a given method of cooling would be

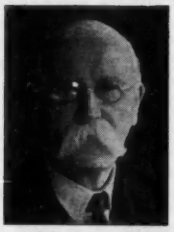
Fig. 2.—Relative current-carrying capacities of stator coils 333in long, designed to occupy the same space, and cooled by air, hydrogen, oil or water



loaded to the maximum under service conditions, the inductive kVAr method was regarded as the most desirable by V. Easton, F. J. Fisher and E. Friedlander (General Electric Co.). This involved three tests: correct stator and rotor currents with consequently reduced voltage and iron losses in the stator; correct stator voltage and rotor current but lower stator current; correct stator voltage and current but higher rotor current. Adjustability of the reactors to any requisite impedance was essential. Mainly for these reasons a 100 MW infinitely controllable transductor had been chosen in preference to an air-gap reactor in spite of slightly higher losses. Its low power factor, 0·008, enabled accurate electrical tests to be made over a wide range of loading and a.c. losses to be predicted under any conditions of service. The value of the test plant was exemplified in a comparison between two 75 MVA alternators both cooled by hydrogen, one at 0·5 lb/sq in and the other at 30 lb/sq in, the latter having a direct-cooled rotor. The result indicated a reduction in transport weight of over 25 per cent for the second machine. Increasing exciter response did not significantly affect synchronous machine performances during the first 0·2 sec, which was longer than the usual fault-clearance time (Humdi-Sepan, Turkey). The full effect became significant only after 0·4 to 0·5 sec.

Capacitors

Reports from six countries, summarised by F. Lehmhaus (Germany), indicated a trend towards an extended use of shunt capacitors rather than more expensive synchronous condensers for compensation of reactive power in networks at all voltages. The general effect was to relieve alternators of the duty. Series capacitors up to 100 MVAr had been installed so far for increasing the transmission capacity of a few high-voltage lines, mainly in Sweden and the U.S.A., and for improving uniformity of load sharing and stability in interconnected systems. External protective devices were not entirely satisfactory at present, but to eliminate them by increasing their internal safety factor would be uneconomic. Nevertheless their application was expected to be extended within the next few years.



Mr. P. R. Coursey

Mr. C. G. Garton

In the construction of capacitors, M. Pierson (Belgium) submitted that porous papers of a modified kraft type were more suitable than dense papers, because of their lower dielectric losses. American and Japanese practice favoured thicker papers in fewer layers to reduce cost.

Non-flammable non-oxidising liquid impregnants (chlorinated diphenyl alone or mixed with chlorinated benzene) for capacitors and transformers were dealt with by P. R. Coursey (Dubilier Condenser Co.) and four foreign collaborators, who drew attention to the better electrical stress distribution across a heterogeneous insulation thus made possible compared with oil. Their high dielectric constant also resulted in smaller physical size. Any increase in dielectric loss due to their solvent action on other materials could be eliminated by the use of activated alumina. They had the further advantage that equipment containing them could be installed without the severe restrictions that normally applied to oil. When

Mr. C. R. King (C.E.G.B.), Mrs. Elphick, Mr. F. J. Lane (Preece, Cardew & Rider) and Mr. J. F. Elphick (C.E.G.B.)

capacitors were not continuously energised at low temperatures damage from void formation down to −25 deg C was preventable by using trichlor diphenyl as the impregnant.

P. R. Coursey also figured as joint author of a paper on ionisation as a chief cause of breakdown of industrial capacitors (others being insufficient dielectric strength and thermal instability) and another paper on the protection of shunt capacitors with fuses, switchgear and discharge resistors. In the first, with C. G. Garton (E.R.A.) and others from Italy and France, ionisation was indicated as a cause of chemical deterioration, which at high stresses led to thermal instability and could become the determining factor in the life of a capacitor. The influence of voltage and methods of detection of the phenomenon were also discussed.

In the other contribution the co-author was H. Walker. It was pointed out that element fuses must withstand charging, standing and discharging currents and yet operate very quickly on fault currents. This requirement was not difficult to meet where elements were in parallel, but became so for series connection; the fewer the elements and the higher the working voltage the greater the problem. If internal fusing was not used, external fusing was almost essential and the minimum number of capacitors per parallel group should preferably be ten, which limited the minimum bank size. The voltage of the smallest economic size of internally fused capacitor was not more than 3 kV whereas with external fusing the limit was about 11 kV, which was imposed by electrical clearances. Particulars of capacitors used in eleven countries were tabulated.

The main reason for the installation of series capacitors was given by S. Lalander and L. Norlin (Sweden) as the reduction of line reactance which, for stability reasons, restricted the loading of long-distance transmission lines to a value below that permitted by the economic copper section. Reduction of the reactance of generators and transformers did not, in general, achieve the requisite improvement. During the past ten years technical problems associated with series capacitors had been solved and units up to 100 MVAr were in commission at 220 and 400 kV in Sweden, U.S.A., U.S.S.R. and Japan. The character of the stability problem was completely changed by the adoption of series capacitors, since they enabled the total transmission reactance to be chosen at an arbitrary figure regardless of length of line, which could be loaded in accordance with economic considerations as for short transmission lines. As loads increased series capacitors could be quickly installed and at less expense than new circuits.

The influence of moisture in transformers on the ageing of insulating papers and on electric strength were dis-

Mr. M. Kaufmann (C.E.G.B.), Mrs. and Mr. W. Casson (C.E.G.B.), Mrs. Kaufmann and Mr. J. Almond (C.E.G.B.)

cussed by J. Fabre and J. Josse, who referred to the insulation of a transformer as a paper-oil combination which functioned both as a dielectric barrier and as a mechanical support. The papers, because of the wedges between coils, were subject to violent compressive stresses under short circuit which could be endured up to a state of deterioration that could be measured only chemically. Acceleration of ageing due to moisture in the papers had been established quantitatively, and this was shown to be as important as dielectric strength.

High-Voltage Cables

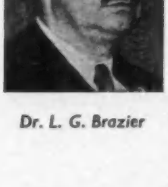
In a special report Dr. L. G. Brazier (British Insulated Callender's Cables) summarised the main features of recent developments in high-voltage cables. A method developed for the laying of heavy submarine power cables from a ship, as successfully applied to the a.c. 138 kV, 120 MW gas-filled cables which link Vancouver Island to the mainland of British Columbia, was described by T. Ingledow (British Columbia Electric Co.) and D. T. Hollingsworth and A. L. Williams (British Insulated Callender's Cables). The link was in two underwater sections of 14·7 and 2·9 miles at a maximum depth of 100 fathoms, with an intervening overhead line. Five cable links were laid at a maximum speed of three knots. Two additional cables to be installed would complete two circuits with one spare cable. Each cable had an overall diameter of 4in and weighed 53·2 lb/yd in air. The cables were made in a factory, the only one of its kind in the world, for the production of continuous unjointed power cables up to 25 miles. The most important requirement was to maintain the cable, especially in regard to mechanical matters, during actual laying and particulars were given of the means adopted.

Particulars of a twin-core flat cable for submarine transmission of direct current were given by J. S. Mollerhoj (Denmark) and C. T. Sutton and A. M. Morgan (Enfield Cables, Ltd.), who pointed out that stress distribution in the dielectric was more complex with d.c. than with a.c. Whereas electric stress was a function of cable dimensions and geometry in both cases, dielectric resistivity in d.c. took the place of permittivity in a.c. With a.c. these functions were unaffected by temperature changes, but with d.c. there was a different stress distribution for every conductor loading. Under transient conditions, especially when a d.c. cable was cooling, the stress at the sheath could rise to a higher value than when continually loaded. A dielectric having the flat resistivity-temperature characteristic of the two-core flat cable avoided these difficulties and did not affect a ship's compass magnetically. The conductors, which had an oil-impregnated paper dielectric and a core screen of semi-conducting paper tapes intercalated with thin copper foil, were laid side by side and enclosed in a lead sheath reinforced with two corrugated metal strips. Jute roving and cotton tapes were then applied and protected by an extruded p.v.c. sheath. Maximum conductor operating temperature was 70 deg C at which sheath stress differed little from that of a cold condition. In the event of damage to the sheath, oil would exude and prevent ingress of moisture.

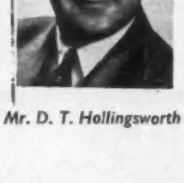
Plastic-insulated cables for a.c. and d.c. transmission were dealt with by R. C. Mildner and E. D. Humphries (Telegraph Construction & Maintenance Co.). After referring to the three mechanisms of dielectric breakdown, viz. gaseous discharges, electrochemical deterioration and thermal instability, in their bearing on synthetic thermoplastic insulation, the authors gave details of tests to indicate the ability of polyethylene to stand up to installation and service requirements. Compared with rubber, synthetic plastics had superior ageing properties due to their chemical inertness, they were relatively free from foreign matter and processing was somewhat simpler owing to their uniformity and homogeneity. Three-phase cables had been made for 33 kV stressed to 40 kV/cm. This was considered to be the highest voltage at present likely for a.c.; for d.c., however, it appeared practicable to design cables (180 to 250 kV/cm) for operation up to at least 200 kV to earth. For sub-

Mr. R. C. Mildner

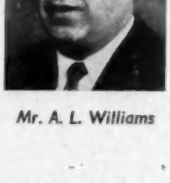
Mr. E. D. Humphries



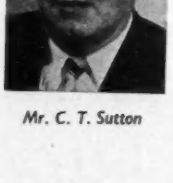
Dr. L. G. Brazier



Mr. D. T. Hollingsworth

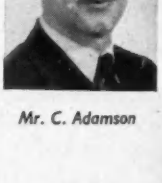


Mr. A. L. Williams



Mr. C. T. Sutton

Mr. A. M. Morgan



Mr. C. Adamson

Left: Messrs. Meldrum, Harper and Howells. Right: Messrs. N. Care (South Wales Switchgear), J. S. Lombard (South Wales Electricity Board) and S. H. Reece (Cobra Wood Treatment), with Mrs. Lombard and Mrs. Care

marine installation the use of a two-core cable with armour overall was proposed.

A report by the committee (S. B. Crary, U.S.A., and others) on system stability included a note by A. Chorlton (C.E.G.B.) on the absorption of reactive power to an important extent by turbo-alternators with a view to reducing the number of machines in operation. Tests in Great Britain and Sweden showed that continuous and quick-acting voltage regulators enabled this to be done by generators of conventional design, but that de-energising limiters might be necessary to avoid loss of synchronism owing to over-action by the regulators.

The decrease of the influence of quick single-phase reclosing as the number of lines in parallel increased was shown by a German study made with the aid of a digital computer. With multiple lines this effect was generally less important than the nature and duration of a fault and the value of inertia constant of the rotating machines. Tests carried out on the 132 kV system in Great Britain in 1956 had shown the possibility of recovery of synchronism after an incident by acting on the excitation and mechanical conditions of a machine out of step.

Apparatus designed for the complete simulation of electrical transient performance of a synchronous generator with voltage regulator was described by C. Adamson (Manchester College of Science and Technology) and A. M. El-Serafi (Egypt). The machine and its regulator were represented by equivalent circuits and the set-up was operated as an integral part of a network analyser. Wide adjustments to the various parameters could be readily made. Compared with other methods of solving similar problems (especially those of the multi-machine kind) the apparatus described was claimed to have substantial economic advantages.

A report of the later proceedings will be published in next week's issue.

ELECTRICITY SUPPLY IN EUROPE

A REPORT on "The Electricity Supply Industry in Europe 1957 to 1975" has been published at 10s 6d by the Organisation for European Economic Co-operation, 2, rue André Pascal, Paris, 16. The document contains 146 pages, of which 65 are allocated to tables giving present and forecast figures over the next five years for eighteen countries. These include, for both public and private generating plants, statistics relating to plant capacity and output, classified types of fuel used with calorific value, kWh taken by groups of consumers and the state of interconnection between different countries.

In the textual matter short-term prospects (up to 1962) and long-term prospects (up to 1975) are discussed. About 60 per cent of the electricity produced is of thermal origin and 40 per cent from water power, but the tendency is for the latter proportion to tail off. In 1956 the following percentages of energy sources used were converted to electricity: hard coal, 20; brown coal, 40; oil refineries, 5; natural gas, 15. Output in that year continued to increase at 8 per cent/annum and reached twice the 1948 level, the greatest expansion recorded over so short a period. Consumption is expected to be 3½ times as large in 20 years' time.

Investment programmes for the next five years are reported to be based on a 7 per cent/annum increase in output, but most countries expect difficulties in raising capital on reasonable terms. Increases in prices to consumers would, however, probably be slight owing to improvements in equipment and consequent saving in fuel. Nuclear energy is estimated to form 30 to 35 per cent of the total thermal energy production by 1975, saving 120 million tons of coal equivalent.

The scope for interchange of electric power between ten countries in Central and South-Eastern Europe is considered in a document of 60 pages issued by the Economic Commission for Europe of the United Nations (3s 6d from U.N. local sales agents). Reserves of various fuels with calorific values and of hydro sources are tabulated, the figures in the former case being converted to electricity production at an assumed average efficiency of 25 per cent. These are related to present consumption and economic position of each country, indicating the surplus energy likely to be available for export. At present only small amounts of electricity are exchanged across frontiers in proportion to the amount produced for home consumption. The potentialities of extending these connections are analysed and discussed, having regard to present and projected high-voltage systems in the areas concerned.

A second publication (70 pages at the same price) is entitled "Electric Power Situation in Europe in 1956" and presents comprehensive statistics of plant installed and electricity production for public and private generating stations in 28 countries and of plants under construction for commissioning between 1957 and 1961. Main features are given of nuclear reactors (for research or for providing power) in being, under construction or planned at 1st January, 1957. High-voltage transmission lines put into service in 1956 are also tabulated. A map is included to show lines of over 220 kV in use or proposed for completion in the near future.

INDUSTRIAL NEWS

British Lighting Council

The British Lighting Council, Ltd., was registered on 4th June as a company limited by guarantee without share capital. The original number of members is 50, each being liable for £1 in the event of winding up. Its objects are to promote and encourage the full and proper use of lighting by electrical means, etc. The income and property of the Association, whencesoever derived, shall be applied solely towards the promotion of its objects. The subscribers are:—British Electrical Development Association, Electric Lamp Industry Council, Ltd., Lighting Equipment Development Council, Ltd., W. B. Noddings, D. B. Irving, W. J. Jones, E. J. Counter, W. T. F. Souter and A. H. Young. The first three named are founder members. The management is vested in a Council, to number not fewer than five, nor more than 25, the first members of which are not named. The founder members each have the right to appoint five members of the Council. The solicitors are Speechley Mumford & Soames, 10, New Square, W.C.2.

Ferranti, Packard to Consolidate

Ferranti, Ltd., has announced plans to consolidate, within the next few months, the operations of Ferranti Electric, Ltd., Toronto, and the Packard Electric Co., Ltd., St. Catharines, under the name of Ferranti-Packard Electric, Ltd., with headquarters in Toronto. The new company will manufacture all products now made by both companies. Mr. T. Edmondson, now president and general manager of the Packard Electric Co., will be appointed president and chief executive officer, and Dr. J. M. Thomson, now president and general manager of Ferranti Electric, will be chairman of the board of directors of the new company. The manufacture of power transformers will be concentrated in Toronto, while instrument transformers, meters and relays will be made in St. Catharines. The electronics and ordnance operations now conducted by Ferranti Electric will continue in Toronto and the manufacture of distribution transformers and meters will continue at the Packard Electric plants in St. Catharines and Three Rivers.

Air Cooling Plant for Priest Rapids

Heenan & Froude, Ltd., are to supply more than 120 tubular air coolers to the English Electric Co., Ltd., for use in the American Priest Rapids Dam. The coolers will be used for the closed circuit ventilation and cooling of the ten vertical-shaft water-turbine alternators—twelve coolers to each alternator. Two additional coolers will be supplied as reserves. Heenan & Froude have also secured a further contract from the English Electric Co. for the supply of specially designed tubular coolers for the lubricating oil of the main thrust blocks of these sets.

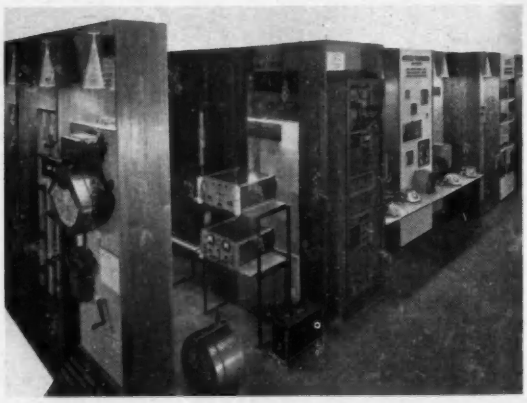
Battery Equipment for British Railways

For British Railways, Southern Region, Pritchett & Gold and E.P.S. Co., Ltd., is supplying a considerable amount of storage battery equipment for the Kent Coast electrification scheme. Thirty-one 110 V batteries of the high performance type, for switch operation, together with thirty-one 50 V batteries for supervisory control, will be installed in the substations, while, in addition, for supervisory control purposes, thirty-four batteries will be installed in track-paralleling huts. Two 50 V batteries of greater capacity will be supplied for the supervisory control room at Canterbury, which will control all substations situated east of a line drawn from Gillingham to Ashford. All of these batteries will be complete with selenium rectifier charging and associated distribution equipment.

The first groups of batteries and chargers are to be installed by August. The remaining batteries and charging equipment are due for delivery in 1959-60, and are required for the electrification of the lines between Ashford and Minster Junction, via Canterbury; Ashford and Dover, via Folkestone; Dover and Minster Junction; and Ashford and Hastings.

Prefabricated Stand at Poznan

A prefabricated exhibition stand, built in London, is being taken to Poznan Fair by Siemens Edison Swan (Export), Ltd. It is adaptable to any required space and Poznan is expected to be only the first overseas show at which this display will be used. The designers were Leonard Callow and Neville Walters and the constructors were Cyprien-Fox Displays, Ltd. The 360 sq ft stand consists of display sections which become nine large packing cases when in transit. When assembled nine exhibition sections are provided together with a reception room for visitors, and a kitchen equipped with a Hotpoint refrigerator to provide cool drinks. The exhibits at Poznan will include a working telephone exchange, telephone instruments, a working ship's telegraph and other marine apparatus, cables for many applications, industrial valves and projector lamps, radio and television components and electro-medical equipment. Two films are to be shown by the company during the exhibition, one dealing with cathode ray tubes and the other with the transatlantic telephone cable.



The prefabricated stand of Siemens Edison Swan (Export), Ltd., which will be erected at the Poznan Fair

A.S.E.E. Exhibitors' Meeting

A meeting of exhibitors at the 1958 Electrical Engineers' Exhibition was held at Caxton Hall, London, last week under the chairmanship of Mr. J. Flood. Mr. P. A. Thorogood (general manager) said that the inclusion of many new exhibitors had enabled the company to stabilise space charges and that no price increases were envisaged for the next exhibition. In reply to proposals that foreign firms should be invited to exhibit, it was suggested that a referendum should be held in which all exhibiting companies would be invited to give their views. A few exhibitors felt that the run of the exhibition might be extended beyond its present period of five days but there was little support for this idea.

During the meeting Mr. Flood announced his retirement as chairman of the company and paid tribute to all who had worked with him in building up the exhibition. He pointed out that applications for space had already been received in sufficient numbers to fill the ground floor of Earls Court, and that many of the exhibitors on the first floor had been so pleased with results that they had requested larger sites at the next exhibition.

Following an announcement that the ballot for space for the 1959 exhibition would be held at Caxton

Hall on 23rd September, Mr. Flood presented a cheque for 400 guineas to the Electrical Industries Benevolent Association.

Computer for Glasgow University

An order for a "Deuce" electronic digital computer has been placed with the English Electric Co., Ltd., by Glasgow University. It will be manufactured at the company's control and electronics division, Kidsgrove, Staffs., and will be used by the University Chemical Department for crystallographic calculation, by the Theoretical Physics Department on problems concerned with atomic structures, and by other departments as required for general mathematical work. The equipment to be supplied will include a new card operated typewriter which has a maximum overall speed of ten characters per second.

Hawker Siddeley, John Brown Nuclear Resources

A well-produced and profusely illustrated brochure has been issued by the Hawker Siddeley, John Brown Nuclear Construction Co., Ltd., which is jointly owned by the Hawker Siddeley Group, Ltd., and John Brown & Co., Ltd., outlining the resources available to the company to qualify it to accept complete and overall responsibility for comprehensive nuclear engineering projects.

Higher Grants for Students

The Minister of Education has issued a memorandum to local authorities setting out the higher grants which will be made to State scholars and students at teacher training colleges, including technical teacher training colleges, from next autumn. Under the new scale the parents with "scale incomes" below £525 will make no contribution; at this figure it will be £10 and thereafter will increase by £14 per £100 of "scale income." The maintenance rates at the universities and university colleges have been increased.

United States Imports of Heavy Electrical Equipment

In response to a petition filed by the General Electric Company of the United States, the Office of Defense Mobilization has initiated a preliminary study to determine whether imports of heavy electrical power equipment are threatening to impair the national security. The study will also provide data for determining whether changes are advisable in the application of the Buy American Act to Government purchases of heavy electric power equipment.

Persons and organisations having an interest in the study are now invited to submit their views and comments (25 copies) to the Director, Office of Defense Mobilization, Washington, 25, D.C. The documents will be made part of the official record and will be circulated to the participating agencies. These include the U.S. Atomic Energy Commission, the Tennessee Valley Authority, the Federal Power Commission and interested Government Departments.

Further information can be obtained from the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, London, S.W.1 (Trafalgar 8855, Ext. 2707).

E.I.B.A. Annual Meeting

The annual general meeting, the Council meeting and the meeting of the Court of the Electrical Industries Benevolent Association will be held on 10th July (10.30 a.m.) in the Council Chamber of the Cable Makers' Association, High Holborn House, London, W.C.1.

Out-of-date Telephones ?

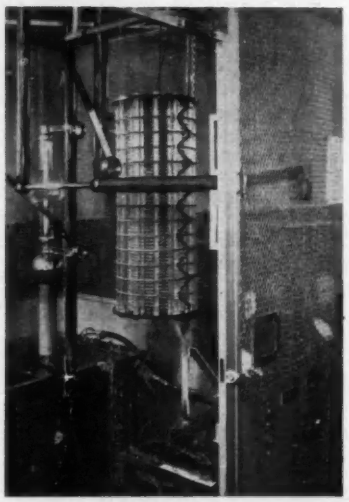
A protest against the reduction of capital expenditure by the Post Office was made by Mr. S. C. Rosser, president of the Post Office Engineering Union, at the union's annual conference at Brighton this week. Mr. Rosser said that although we were one of the first countries to introduce automatic switching we were now from twelve to twenty years behind some Continental countries. Holland and West Germany, for instance, had already provided subscriber trunk dialling for the majority of their subscribers but we would have to wait until 1970 for similar progress.

Trade unionists' interest in this subject lay in the fact that they realised that as long as the telephone service was run with out-of-date equipment they could never hope to get a decent reward for their work. He feared that unless the system was modernised quickly it would get into the same state as the railways.

An exhibition of labour-saving machinery was arranged jointly by the Post Office and the union during the conference. One item was a cable plough, which cuts a shallow furrow and lays a new type of polythene cable at the same time. Another exhibit was a modified "Land Rover" to draw in cable, with compressors for breaking up a road surface. Mr. C. Smith, general secretary of the union, said that they were in continuous discussion with the Post Office about the introduction of new mechanical devices, but their principal concern was that the existing aids were not always used as fully as they could be.

Component Manufacturers' 21st Anniversary

An open day was held on 29th May by Welwyn Electrical Laboratories, Ltd., Bedlington, Northumberland, to celebrate their 21st anniversary which occurs this year. The company manufactures vitreous enamel wire wound resistors, high stability carbon resistors and other components for the radio and electronic industries. In 1945 the activities of the company had grown to such an extent that it was no longer able to obtain suitable premises in Welwyn Garden City and during 1949 the new factory was obtained at Bedlington.



Testing a special resistor assembly mounted in a high voltage cage at Welwyn Electrical Laboratories, Ltd.

The guests at the open day were welcomed by Mr. J. R. Hunt, managing director. Before and after the buffet lunch there was a comprehensive tour of the factory, including a visit to the research laboratories and test section. The amount of money spent on research and development by the company is equivalent to 8 per cent of its turnover; this is above the average for the country. Mr. R. Wilton, director, Welwyn Canada, Ltd., gave an address after lunch. He said that the range of products manufactured in Canada was restricted compared with those manufactured by the British company. The main reason for establishing Welwyn Canada was to exploit the American market. Welwyn International, in Cleveland, Ohio, sold the products of both Welwyn Canada and Welwyn England to the American market.

Mechanical Handling

The June issue of *Mechanical Handling*, the journal which organised the Mechanical Handling Exhibition at Earls Court last month, is a special exhibition report number. It is lavishly illustrated and contains an 80-page study of all equipment and systems at the show. This special issue is obtainable at the usual price, 2s 6d.

New Lister Diesel Engines

On 2nd June R. A. Lister & Co., Ltd., held an exhibition at Park Lane House, London, to introduce its new ranges of Lister air-cooled diesel engines, which include 20 h.p. and 30 h.p. (HA range) and 4½ h.p., 8½ h.p. and 12½ h.p. (SL range) engines. The first public display will be at the Royal Agricultural Show at Bristol at the beginning of July. The company is

holding a series of exhibitions of these new prime movers for the benefit of civil engineering contractors, plant manufacturers, representatives of nationalised industries, etc., on the following dates: — 17th-19th June, Grand Hotel, Leicester; 24th-26th June, Midland Hotel, Manchester; 1st-3rd July, Griffin Hotel, Leeds; 8th-11th July, Scottish Building Centre, Glasgow; and 15th-17th July, Royal Station Hotel, Newcastle-on-Tyne.

"Scanning the Provinces"

Although the third edition of "Scanning the Provinces," issued by Northcliffe Newspapers Group, Ltd., is primarily intended for the use of advertisers and advertising agents, it includes much information of general interest of the towns covered by the group's evening and weekly papers. Statistics are included of such matters as population, retail outlets, local government, rates, gas, water and electricity, industrial employment, etc.

U.K.A.E.A. Publications

Lists Nos. 28 and 29, detailing the publications now generally available, have been issued by the United Kingdom Atomic Energy Authority. These lists include original documents and translations issued by the Authority and its Industrial Group and articles from periodicals contributed by the Authority's staff. A list of depository libraries from which the documents may be borrowed is given.

"People and Plastics"

At the offices of Bakelite, Ltd., last week we were shown a film, in colour, bearing the above title. Its purpose is to present the many uses to which polyethylene is put and this it does very effectively. Brief explanations of extrusion and injection moulding are given in the course of the film and the applications illustrated include wrappings, pipes and submarine cables which are shown in course of production. The film was produced and photographed by Mr. E. W. A. Jefferies, publicity manager of Bakelite, Ltd., and it reaches a really "professional" standard. The majority of the "actors" were members of the company's staff.

London Transport Strike

Last Monday about 230 drivers and guards employed on the London Underground Railways failed to report for duty, having decided on a token strike in support of the London busmen who have now been out for six weeks. The services were cut by about 10 per cent, but the swollen traffic caused by the bus strike was successfully handled. Normal conditions prevailed on Tuesday. The drivers and guards have threatened to repeat their token strike every Monday until the bus dispute is settled.

Electrical Contracting Wages

Further negotiations between the National Federated Electrical Association and the Electrical Trades Union have resulted in a settlement of the union's claim for increased wages. As from 30th June, the hourly rate for skilled craftsmen will be increased by 2½d with consequential adjustments in other grades. The hourly skilled rates will then be: London, 5s 2½d; Mersey District, 5s 0½d; Provinces, 4s 9½d. Mates' rates: London, 4s 3½d; Mersey District, 4s 2½d; other areas, including Northern Ireland, 3s 11¾d per hour.

The N.J.I.C. for the Electricity Supply Industry is to meet on 18th June when the Board's side is expected to make its final reply to the trade union's claim for a general increase in wages.

B.I.C.C. Birmingham Store and Offices

British Insulated Callender's Cables, Ltd., opened on 2nd June its new Birmingham store and sales offices at 67-77, Holloway Head, Birmingham, 1 (telephone: Midland 6922). The store, with a floor area of 11,000 sq ft, will enable the company to double stocks of cable held locally, formerly held in a number of temporary stores. There is 3,000 sq ft of office accommodation on the ground and first floors for the staff of the Birmingham branch manager, Mr. P. Greaves, and that of the Midland regional manager, Mr. A. R. Leith. The new premises were officially opened by Mr. W. S. Lewis, chairman of the Midlands Electricity Board.

At the opening of the new Birmingham store and offices of B.I.C.C. Left to right: Mr. A. R. Leith (Midland regional manager, B.I.C.C.), Mr. R. O. Batley (regional director, C.E.G.B.), Mr. C. H. Broughton Pipkin (manager (home sales), B.I.C.C.) and Mr. W. Lewis (chairman, Midlands Electricity Board)

Trade Announcements

To meet the increasing demand for ferrites in the computer industry, the Chemical and Metallurgical Division of the **Plessey Co., Ltd.,** has recently moved a section of its plant engaged in the production of magnetic memory planes and stores to a new factory near the parent factory at Water Lane, Towcester. Entirely functional in layout, well lit and airy, the new factory has been designed with particular emphasis on natural daylight conditions so that assemblers engaged in constructing these memory stores, work which demands a high degree of accuracy, will not be subject to eye strain.

J. R. Ferguson (Electrical Engineers), Ltd., Dukinfield, Ches., announce the completion of an agreement with the Federal Pacific Electric Co., New Jersey, U.S.A., for the provision of technical information, layout of plant and provision of tools. The agreement will enable the Federal Pacific Electric Co. to develop epoxide resin moulding on its products in the United States.

Maiden & Co., Ltd., Hyde, Ches., and the **Landis Machine Co.,** Waynesboro, United States, have amalgamated to form a new company in Great Britain — **Landis Machine-Maiden, Ltd.**—operating from Hyde, Ches., for the construction of screw threading machines. In addition to the current "Maiden" range, the new company will include the manufacture of tangential chasers and other Landis products.

The offices and showrooms of the north-east region of **Philips Electrical, Ltd.,** are now at 72, Wellington Street, Leeds, 1 (telephone: Leeds 36141), and the trade counter and stores premises at 2, Britannia Street, Leeds, 1.

Small Electric Motors, Ltd., has appointed Mr. R. T. Shenton, who was previously with Veritys, Ltd., as its sales engineer in the Midland area, and Mr. G. Parkinson, previously with Crompton Parkinson, Ltd., as its sales engineer in the Yorkshire and Cheshire area.

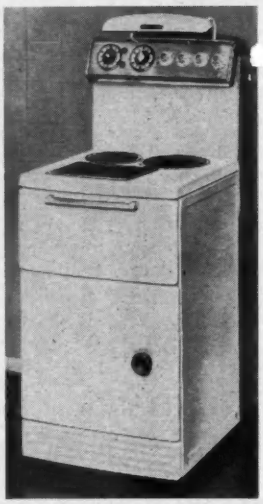
After a long association with James Ferguson & Munro, Ltd., **Evershed & Vignoles, Ltd.,** have decided, as a matter of policy, to terminate the agency and have direct representation in Scotland. The Scottish area office at 13, Rutland Street, Edinburgh, 1 (telephone: Fountainbridge 3058), is under the management of Mr. R. M. Wardrop.

The **Keyswitch Co.** is now established in its new factory at Irongate Wharf Road, Praed Street, London, W.2 (telephone: Paddington 2231/2/3).

NEW ELECTRICAL EQUIPMENT

Electric Cooker

Details of the new "Marquis" electric cooker, to be shown for the first time at the B.E.P.C. Convention exhibition next week, have just been announced by the manufacturers, TRICITY COOKERS, LTD., 109, Kingsway, London, W.C.2. Designed as a luxury cooker, it incorporates many



Tricity "Marquis" electric cooker

improvements and there are no optional extras. All the controls, including a 5-hr minute timer and a timer switch, are mounted at eye-level on the top of the splash plate, which is so shaped that vapours are deflected from the controls and the strip-light fitting which is mounted above. Hob fittings include two radiant plates (6¼ and 8in) and a rectangular grill boiler. All plates are controlled by simmer devices.

Below the hob there is a two-in-one hotcupboard/grill chamber, claimed to be the largest yet provided in a domestic cooker. It is fitted with a drop-down door and a removable shelf permits maximum use to be made of the available space. The extra large oven (3,600 cu in) is thermostatically controlled and has a full width inner glass door. When the oven door is opened an internal light is switched on automatically. The cooker is finished in either cream or white vitreous enamel and the hotplate surrounds are chromium plated. The price, complete with vitreous enamel grill pan and meat tin, is £57 18s.

Calculating Unit

A magnetic core calculator, type 628, which combines the simplicity of a control panel calculator with a large storage and programme capacity, has been introduced by the IBM UNITED KINGDOM, LTD., 101, Wigmore Street, London, W.1. The machine will thus serve the application area between the company's 604 electronic calculator and the 650 medium-size computer. The 628, like the 604/421 system, is designed to work in conjunction with a card punch (type 565) and the high-speed 421 accounting machine. In the basic system the punch allows an input/output speed of 100 cards per minute. When the high-speed accounting machine is also attached, the 628 unit has an input of 150 cards per minute and can print 150 lines per minute: while printing, it can cause the 565 to punch summary cards through a special buffer in the accounting machine.

The 628 has an electronic storage capacity of 320 digits. Its programme can consist of up to 160 programme steps which can be taken by selection in any sequence, thus making the extent of the programme virtually unlimited. With the improved logic, programming and increased storage of the machine, three or four passes of cards on the IBM 604 can be achieved in certain applications on the 628 in one run. The 628 is able to add or subtract in 180 microseconds, multiply ($8 \times 8 = 16$ digit product) at an average speed of 8 milliseconds, and its core storage has an access time of 10 microseconds. Its magnetic core arithmetic unit consists of 16 positions and checking features are incorporated.

Bunker Level Switch

A pressure operated bunker switch which will operate contacts when the level of material in a bunker reaches or falls below a predetermined level is announced by LONDEX, LTD., Anerley Works, Anerley Road, London, S.E.20.

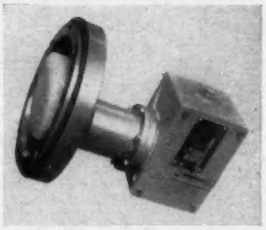
The "Simcar" switch is ideal for heavy or abrasive materials, such as coal, and also where extreme conditions of dust and moisture exist. The standard switch is designed for operating in bunkers handling 5in raw material. It is mounted into the side of a hopper in the vertical plane. When the level of material reaches the switch the pressure exerted on the face pad is transmitted via a liquid in the main housing to the bellows-operated pressure switch. Snap-action, single-pole, double-throw, silver contacts then operate, these being rated at 5 A 250 V a.c. or 3 A 440 V a.c.

The brass housing is filled with ethylene glycol which is retained on the outward face by a thick rubber diaphragm which carries a pressure pad which projects into the bunker. This pad is usually manufactured from a tough plastic and has proved particularly successful with coal, eliminating any danger from incendive sparking. For certain other materials, such as stone chippings, etc., an aluminium alloy pad is fitted.

Portable Insulation Flash Tester

As a result of their experiences during the past few years GRESHAM TRANSFORMERS, LTD., Hanworth, Middlesex, have recently developed the Gresham Mark III portable insulation flash tester. The principle of operation is quite simple. A voltage between 500 V and 2,500 V, as required, is applied to the circuit under test by means of two shockproof probes. If a fault is found a short-circuit is indicated, and the testing voltage is automatically switched off. If necessary the faulty insulation may be burnt out to locate the fault. The instrument is claimed to be foolproof.

The improved quick-acting circuit-breaker is connected to the input circuit and trips at approximately 2·5 A input current. When it is desired to burn the fault so that, for example, smoke will indicate its position, the "burn-fault" switch will bring into the circuit current limiting resistances which will prevent the circuit-breaker from tripping. Safety is ensured by a thermostat, which opens the circuit-breaker before the limit of the safe operating temperature is reached. The input and output circuits are electrically isolated. The



Londex bunker level switch

Right: Gresham Mark III portable insulation flash tester

test probes are of polished ebonite with retractable shields so that the live probes cannot be bared until they are actually applied to the circuit under test. They cannot normally be fingered and the probe shields are provided with "Mycalex" tips, which ensure that there is no flash-burning of the ebonite. The price is £67 10s ex works.

Transistor Amplifier

A portable transistorised amplifier which weighs only 5½ lb and can be used in any mobile or fixed site where a mains electricity supply is not available is announced by PYE TELECOMMUNICATIONS, LTD., Cambridge. The Pye PTC 1010 10 W transistor

Pye PTC 1010, 10 W transistor amplifier

amplifier is suitable for use wherever speech or music must be amplified. It can be used in mobile police cars; at sports meetings; and, in fact, on any occasion where a loudspeaker system is necessary but the installation of the conventional and more complicated amplification system is found impracticable. The amplifier measures 8in wide by 3½in deep by 6in high. It requires a 12 V power supply from dry batteries or an accumulator and even with the full output of 10 W, the consumption is only 1·8 A. A comprehensive selection of microphones and loudspeakers for use with this amplifier is also available.

Distilled Water Apparatus

Apparatus for providing distilled water instantly, at tap speed, for battery service is announced by DEIONISATION (ELGA), LTD., Railway Place, London, S.W.19. Ordinary tap water is fed in through the base of the Elga "Top-It-Up" and passed through a column of ion exchange resins. These remove impurities and pure distilled water flows from the outlet pipe.

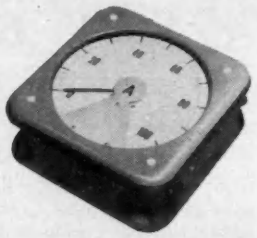
Elga senior model water distilling apparatus

The ion exchange resins are contained in a cartridge which can be replaced in a few seconds when exhausted. The distilled water output capacity of each cartridge depends on the condition of the input water and can vary from 300 to 30 gallons per cartridge for the senior model and half this quantity for the junior apparatus.

Portable Instruments

Industrial type "Cirscale" ammeters and voltmeters are now available as portable test instruments from the RECORD ELECTRICAL CO., LTD., Broadheath, Altrincham, Cheshire. Their rugged construction withstands rough handling, while the extra long scale coupled with an anti-parallax platform dial enables snap readings to be made with ease and accuracy.

The top and bottom of the case are formed by square die-castings while the rest of the case is of oiled teak.



Record portable "Cirscale" ammeter

The case is so shaped as to provide a natural grip for the fingers and thus requires no carrying handle. Terminals are recessed so that they are protected from damage and are readily accessible. The movements are the same as are used in "Cirscale" switchboard instruments. Moving coil instruments are provided from 250 mA up to 50 A and from 60 mV to 600 V self-contained. Moving iron instruments are provided from 10 mA up to 50 A and from 10 V to 600 V self-contained. Multi-ranges are available. With a nominal dial diameter of 6in the scale length is 11in approximately. The case size is 7¼in by 7¼in by 3½in.

CATALOGUES AND LISTS

BATTERY CHARGER.—Leaflet (F/HC1) on the company's "Home" portable battery charger for 6 and 12 V batteries.—**Standard Telephones & Cables, Ltd.**, Edinburgh Way, Harlow, Essex.

CABLES.—44-page illustrated catalogue covering the range of "Ashton" and "Ashathene" cables and flexibles, leaflet dealing with coloured flexible cables and two information sheets on "Ashatherm" floor warming cables and multipoint communal aerial systems.—**Aerialite, Ltd.**, Castle Works, Stalybridge, Cheshire.

Illustrated 24-page catalogue giving details of "Mersey" wiring cables.—**Mersey Cable Works, Ltd.**, Linacre Lane, Bootle, Liverpool, 20.

GUILLOTINE.—Leaflet illustrating and describing the "Autogil" tube-cutting guillotine suitable for dealing with a variety of materials including electric wires and insulating materials.—**Wallis Engineering Co.**, 399, Warwick Road, Birmingham, 11.

INSTRUMENTS.—Series of five leaflets illustrating and describing instruments in the company's range, including thermocouple potentiometers, resistance boxes and bridges and a pH meter and pH electrodes.—**Doran Instrument Co., Ltd.**, Stroud, Glos.

INSULATING MATERIALS. — Five leaflets dealing with standard and new insulating materials produced by the company.—**Micanite & Insulators Co., Ltd.**, Empire Works, Blackhorse Lane, Walthamstow, London, E.17.

LIGHTING FITTINGS. — Catalogue (28 pp.) illustrating and describing fluorescent and commercial and industrial lighting fittings supplied by the company.—**Bell Bros. & Co. (London), Ltd.**, 37, Camomile Street, London, E.C.3.

Brochure giving prices and particulars of "Silver-Luxe" industrial well-glass and bulkhead fittings and details of a range of spun aluminium reflectors.—**Metway Electrical Industries, Ltd.**, Canning Street, Brighton, 7.

Illustrated catalogue (L.600, 46 pp.) covering certified flameproof lighting fittings, certified weatherproof-flameproof lighting fittings and industrial weatherproof-dustproof lighting fittings, together with accessories such as junction boxes, cable sealing boxes, distribution switchboards, etc.—**Victor Products (Wallsend), Ltd.**, Wallsend-on-Tyne.

LIGHTNING PROTECTION EQUIPMENT.—Leaflet (F.6) illustrating and describing "Omega" lightning protection equipment for power stations and tall chimney shafts, and two leaflets dealing with lightning conductors and tubular earths.—**W. J. Furse & Co., Ltd.**, Traffic Street, Nottingham.

MAGNETS.—Two brochures dealing with "Feroba" ceramic permanent magnets and vacuum sintered permanent magnets.—**Darwins, Ltd.**, Fitzwilliam Works, Sheffield.

Leaflet on the company's "Stanferite" magnetic materials.—**Standard Telephones & Cables, Ltd.**, Magnetic Materials Department, North Woolwich, London, E.16.

PRINTED CIRCUITS.—15-page booklet (PC.1) illustrating and describing the design and production of printed circuits as carried out in the company's Computer Department.—**Ferranti, Ltd.**, Hollinwood, Lancs.

REACTOR.—Descriptive leaflet on the company's S.O.S. (saturable overload shunt) reactor designed for the protection of a.c. instruments against overload, the limitation of instrument burdens on current transformers and for giving any desired saturable characteristics to current transformers.—**Smith Hobson, Ltd.**, Hersham Trading Estate, Walton-on-Thames, Surrey.

SOLDERING IRON.—Illustrated leaflet (116) giving particulars of a small electric soldering iron for low voltage operation.—**Electrical Remote Control Co., Ltd.**, Elremco Works, Harlow New Town, Essex.

SWITCHGEAR.—Brochure (1458) giving particulars and prices of a range of push-button control stations, limit switches and float switches.—**Barries Electrical Agencies, Ltd.**, Canning Street, Kemp Town, Brighton, 7.

VALVES AND C.R. TUBES.—32-page catalogue showing the full range of industrial valves and cathode ray tubes produced by the company.—**M-O Valve Co., Ltd.**, Brook Green, Hammersmith, London, W.6.

GENERATION AND DEVELOPMENT

C.E.G.B. Contracts

The Central Electricity Generating Board has placed contracts during the past month for power stations, transmission lines and transforming stations amounting in the aggregate to £4,981,670. They include the following:—

High Marnham power station, near Tuxford: Main and auxiliary power cables, control and instrument cables. —Drake & Gorham (Contractors).

Willington "B," near Derby: Main civil engineering works.—M. J. Gleeson (Contractors). Ash and dust handling plant.—Babcock & Wilcox.

Rugeley: Condensing and feed heating plants.—Hick, Hargreaves & Co.

Aberthaw and Skelton Grange "B": High pressure pipework and valves.—Babcock & Wilcox.

Ffestiniog: Tan-y-Grisiau dam and reservoir works.—Sir Alfred McAlpine & Son.

Elland, Yorks.: One reinforced concrete cooling tower.—Davenport Engineering Co.

Bradwell substation: 132 kV and trunk multicore cables.—W. T. Glover & Co.

Cowley and Dowlais substations: 45 MVA 132/33 kV transformers.—Fuller Electric & Manufacturing Co.

Uskmouth "B" substation: 132 kV and auxiliary cables.—Pirelli-General Cable Works.

Staythorpe "B" substation: Site and foundation works.—Turriff Construction Corporation.

Aberthaw-Pyle/Upper Boat: 275 kV overhead line.—British Insulated Callender's Construction Co.

Views on Gas-Electricity Co-operation

The forty-third meeting of the East Midlands Electricity Consultative Council was held at Nottingham on 4th June. On co-operation between Electricity and Gas Boards, the Council considered that while it might be a little more convenient to the public if joint service centres were established, the cost would be heavy and disproportionate to any advantages gained. Difficulties were also foreseen over the staffing of joint centres. The Council doubted whether staffs could be trained up to a standard where they could give adequate advice on matters connected with both electricity and gas services. In regard to payment facilities, the view was expressed that consumers would certainly appreciate the facility of being able to pay both electricity and gas accounts at either electricity or gas service centres.

In the absence of comparative costs, the Council was unable to reach any firm conclusions on joint meter reading and billing. A point made, however, was that one quarterly bill for both types of consumption would undoubtedly be an embarrassment to a great many consumers whose household budgets were based on the "staggering" of their payments for electricity and gas supplies.

Transfer of Rhymney Valley Undertaking

On 1st June the South Wales Electricity Board took over responsibility for electricity supplies to some 2,500 premises in the Rhymney Valley area hitherto served by the National Coal Board. The Electricity Board is to undertake extensive reinforcement works immediately, estimated to cost some £162,000, in order to provide adequate and efficient supplies to the consumers concerned. As soon as appropriate stages of the reconstruction and reinforcement works have been completed supplies will be converted to the standard 240 V a.c.

Street Cable Works

Gateshead Corporation has discussed with the public utility undertakings the question of co-ordinating plans to reduce the number of times streets are broken up for the laying of cables, mains, etc. The North Eastern Electricity Board, the Northern Gas Board, Newcastle and Gateshead Water Co., the Post Office, and Rediffusion, Ltd., have agreed to exchange programmes of intended work, and will endeavour to form a common programme as far as possible.

Improved Supply to New Town

To meet the growth of load, the South of Scotland Electricity Board has approved a scheme, estimated to cost £93,300, for the reinforcement of supply to the new town of East Kilbride. The work, which is expected to be completed by the end of next year, will include the constructing at Common Farm of a 33 kV substation, to be supplied from Market Hill substation, and the carrying out of modifications to the existing 11 kV network.

Supply to Sandale Television Station

The Ministry of Power has decided that two sections of an electricity cable to be constructed from Caldbeck (Cumberland) to the Sandale television transmitting station should be placed underground. A Ministry inspector who held an inquiry into the proposal last January had recommended that the line should be overhead for the whole distance of four miles, as planned by the North Western Electricity Board, but the Ministry decided that on two sections of the route the cable should be underground to preserve amenities.

Street Lighting

Mr. Henry Brooke, the Minister of Housing and Local Government, last quarter authorised local authorities to borrow £577,944 for public lighting.

Approval in principle is recommended to proposals for street lighting improvements in certain main thoroughfares in **Hampstead**, provision for which expenditure has been made in the capital estimates for the year 1958-59, amounting to £27,060. The roads under consideration are Haverstock Hill, Rosslyn Hill, Hampstead High Street, Heath Street (part), North End Way, Adelaide Road and Belsize Road.

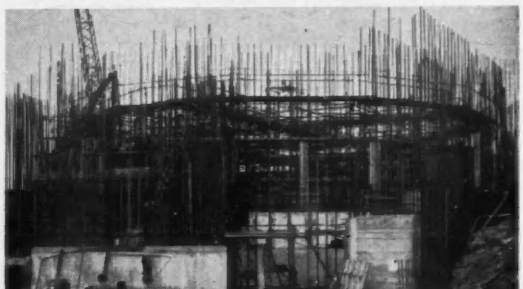
A street lighting scheme for **Kidderminster** costing not more than £15,000—the first part of a programme for the complete modernisation and electrification of the lighting in the town—is to be prepared provided a loan can be obtained for the purpose.

Having considered a report on the street lighting plans of adjacent local authorities, **Ealing** Works and Highways Committee has authorised the preparation of a scheme of sodium lighting in Gunnersbury Lane.

Smethwick has been told it cannot go ahead this year with a scheme to install electric lighting throughout the town.

Redcar Town Council is to spend another £5,350 converting street lighting from gas to electricity.

Street lighting improvements in **Southampton** for which it is proposed to seek Ministry of Transport approval are estimated to cost £11,379.



The first reactor house taking shape at the Hinkley Point atomic power station. In the foreground are the block concrete foundations for the biological shield. The station, which is being built for the Central Electricity Generating Board by the English Electric, Babcock & Wilcox and Taylor Woodrow Atomic Power Construction Co., Ltd., will have a net electrical output of 500 MW when it is completed in 1962

Financial Section

STOCKS and SHARES

PREPARATIONS for the launching of a £25 million debenture stock issue by Associated Electrical Industries have been one of the main points of interest in generally quiet but steady Stock Exchange markets. Most of this stock is to be offered for public subscription at a price of 98½, of which £20 per cent will be payable on application. Yesterday (Thursday) was the day for the advertisement of the prospectus, and the lists are to open next Tuesday. Special consideration will be given to applications on forms provided to holders of the company's preference and ordinary stocks. In advance of the event, market opinion regarded the terms as favourable in comparison with prices ruling for other top-class industrial debentures, for which there exists a steady investment demand.

Good Features

Activity in the industrial markets has continued to be severely restricted, but prices have been fairly well upheld and good features have not been lacking. Crompton Parkinson 5s shares have been in strong demand since the announcement of an increase equivalent to 1 per cent in the interim dividend for the financial year which ends this month; the announcement said that the decision should not be taken to indicate a larger total. At 10s 6d, the price has risen 1s 9d since the declaration. Allen West shares have been another outstandingly firm feature of the electrical market. They rose from 10s 3d to 11s 6d in the past week, evidently still under the influence of the good annual results reported earlier. Similar considerations would account for further improvements in Head Wrightson and Mather & Platt. B.I.C.C. have added 2s 3d to previous gains since the annual meeting, and others to show up well included E.M.I., Aerialite, Switchgear & Cowans and Dubilier Condenser.

Elliott-Automation Report

Investment confidence in the future of automation is reflected in a yield of not much over 3½ per cent on the 5s shares of Elliott-Automation, which were marked up from 13s 3d to 14s 3d on the appearance of the first annual report to be issued since the merger of Elliott Bros. and Associated Automation. In his review, the chairman tells shareholders that turnover was substantially higher in 1957 than in the previous year, and that at the end of the period orders in hand were about £2½ million larger than at the beginning. Profits, after tax, came out at £412,000, and the ordinary dividend, as announced earlier, is at the annual rate of 10 per cent forecast at the time of the amalgamation. In the year now running, Mr. de Trafford reports that profits have remained on the upgrade, and speaking of this year's sale of the interests in Associated Insulation Products to A.E.I., he says that this added some £1·7 million net to the group's cash resources.

Chloride Electrical Storage

Last year's slump in commodity prices, which had particularly expensive

Price Changes in

Company or Board	Nom. Value	Middle price 9th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	75		3	3	4 0 0	75½	72
Brit. Elec. 1974/77	100	72½		3	3	4 2 9	72½	68½
Brit. Elec. 1976/79	100	76		3½	3½	4 12 0	76	72
Brit. Elec. 1974/79	100	86½	+½	4½	4½	4 18 3	86½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6†	6·8†	8 10 6†	16/9	15/-
East African Power	£1	18/-	−6d	7	7½	8 6 9	19/3	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	14/9
Perak Hydro-Elec.	£1	14/6		10	12½	17 4 9	15/6	14/-
Electrical Shares								
Aberdare Holdings	5/-	11/9	+3d	17½	17½	7 9 0	11/9	9/9
Aerialite	1/-	7/-	+6d	48	51½	7 7 0	7/-	5/1
Allen, W. H.	£1	36/3	+1/3	10	11	6 1 3	36/3	32/9
Anglo-Portuguese Tel.	£1	26/9	−6d	8	9	6 14 6	27/3	19/9
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	55/9	53/-
Assoc. Elec. Ord.	£1	47/6		15	15	6 6 3	51/3	46/6
Automatic Tel. & El.	£1	63/9		17	17	5 6 6	66/3	57/-
Babcock & Wilcox	£1	47/9		15	13‡	5 8 9	52/9	41/9
Bakelite	10/-	19/3	+6d	15	15	7 15 9	21/-	17/6
Baldwin, H. J.	2/-	3/-		20	20	13 6 9	3/9	2/9
Berry's Electric	5/-	7/-		—	10	7 2 9	7/6	5/9
British Aluminium	£1	42/6	+1/9	12	12	5 13 0	47/-	37/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	24/-		22½	25	5 4 3	24/-	19/6
B.I. Callender's	£1	45/6	+2/3	12½	12½	5 10 0	45/6	38/9
B.I. Callender's 6% Pref.	£1	19/6		6	6	6 3 0	20/3	19/6
British Tabulating	£1	47/6	+9d	9	10	4 4 3	47/6	38/6
British Thermostat	5/-	27/6		25	30	5 9 0	27/6	19/9
British Vac. Cleaner	5/-	4/9		10	10	10 10 6	5/3	4/6
Brook Motors	10/-	37/6		25	25	6 13 3	37/6	33/3
Bulgin, A. F.	1/-	5/-		40	45	9 0 0	5/6	4/7
Bulpitts	5/-	7/6		—	12½‡	8 6 9	7/6	7/6
Burco Dean	5/-	9/-		20	22½	8 6 9*	9/6	7/9
Cable & Wireless: Ord.	5/-	10/6	+6d	10	10‡*	4 15 3	10/6	8/-
4% Loan	100	94		4	4	4 5 0	94½	89
Chloride El. Storage "A"	£1	56/9	−3d	17½	17½	6 3 3	62/-	55/6
Clarke Chapman	£1	112/6		27½	27½	4 17 9	7½	5½
Cole, E. K.	5/-	17/6		17½	17½	5 0 0	18/-	15/6
Cossor, A. C.	5/-	4/6		Nil	2½	2 15 6	5/6	4/4
Crabtree	10/-	26/-		20	20	7 13 9	26/3	24/4
Crompton Parkinson Ord.	5/-	10/6x.d.	+1/-	16	16	5 1 6*	10/6	8/3
De La Rue	10/-	25/6		30	35	6 17 3*	25/6	20/9
Decca "A"	4/-	24/3	−3d	43½	43½	7 4 3	27/6	21/3
Desoutter	5/-	14/6		32½	18½*	6 9 3	14/6	13/6
Dewhurst	2/-	8/-		16½	20	5 0 0	8/-	6/9
Dictograph Tel.	2/-	6/-x.d.		20	20*	6 13 3	6/-	4/7
Dubilier Condenser	1/-	3/9	+3d	30	30	5 6 9*	3/9	3/1
Duport	5/-	7/9x.d.		25	25	8 1 3*	9/4	7/9
E.M.I.	10/-	35/-	+1/3	15	15	4 5 9	35/-	27/6
Electrical Components	5/-	7/6		2£	12½*	8 6 9	8/-	7/-
Elec. Construction	£1	22/6		8½	8½	7 11 0	22/9	21/-
Elliott-Automation	5/-	14/3	+1/-	—	10‡	3 10 3	14/6	11/6
Enfield Cable Ord.	£1	15/6		Nil	2½	3 4 6	17/-	10/9
English Electric	£1	51/3		14	14	5 9 6	56/3	44/-
English Electric 3½% Pref.	£1	12/3		3½	3½	6 2 6	12/3	11/9
Ericsson Tel.	5/-	20/3	−3d	22†	12*†	2 19 3†	21/-	17/6
Ever Ready	5/-	17/6x.d.		37½	20*	5 14 3	17/9	13/9
Falk Stadelmann	£1	38/9		17½	17½	9 0 9	38/9	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

consequences for most of the cable manufacturing and other large copper using companies, was said at the annual meeting of the Chloride Electrical Storage Co. to have been a considerable factor in the financial results of that company as a holder of large stocks of lead. In conjunction with increased competition and costs, this accounted largely for the fact that although total group sales, at home and abroad, were larger in 1957 than in the previous year, the trading income was somewhat lower at £2·8 million. On the other hand, the balance sheet shows an improvement of the order of a million in liquid resources, and the reserve for stocks and materials is now more than adequate for requirements. After tax and all charges, the net surplus of profits covers comfortably the maintenance of the dividend at 17½ per cent, on which the £1 shares at a price of 56s 9d show a yield of over 6 per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 9th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	31/3	+1/3	14	12½	—	38/9	29/3
G.E.C. 6½% Pref.	£1	20/-		6½	6½	6 10 0	21/3	20/3
General Cables	5/-	11/9		30	24	10 4 3	11/9	11/-
Greenwood & Batley	£1	47/3		17½	17½	7 8 3	48/-	45/-
Hackbridge Holdings	5/-	12/9		30	20	7 16 9	13/3	7/6
Hackbridge & Hewittic	5/-	12/-		23	20	8 6 9	12/-	9/7
Head Wrightson	5/-	21/6	+1/6	22½	17½*	4 1 6	21/6	16/9
Heatrae	2/-	5/6		15	20	7 5 6	5/6	4/-
Henley's	10/-	11/6	−3d	11½	11½	10 0 0	14/6	10/6
Holophane	5/-	13/6		30	37½	8 6 9*	13/9	12/6
Hoover	5/-	40/-	+6d	50	50	6 5 0	40/6	31/-
I.C.I.	£1	44/3		10	12	5 8 3	45/-	35/6
Intl. Combustion	5/-	23/6		22½	25	5 6 6	24/6	19/3
Johnson & Phillips	£1	19/6	+9d	10	5	5 2 6	25/-	15/-
Lancashire Dynamo	£1	37/6	+1/3	11	11	5 17 3	37/6	28/6
Laurence, Scott	5/-	13/9		15	15	5 5 3	14/9	12/6
Lister, R. A.	£1	24/6		10	10	8 3 3	26/3	23/-
London Elec. Wire	£1	43/9	+1/3	12½	12½	5 14 3	43/9	39/6
Lucas, J.	£1	33/-		7½	7½	4 11 0	33/3	27/9
Marconi Marine	£1	32/-		10	10	6 5 0	32/-	29/-
Marryat & Scott	2/-	12/-		30	35	5 16 9	12/-	10/3
Mather & Platt	£1	58/3	+1/6	15	15	5 3 0	58/3	43/9
Metal Industries	£1	31/6	+2/6	Nil	9	5 14 3	31/6	22/9
Midland Elec. Mfg.	£1	45/-		12½	12½	5 11 0	48/3	44/-
Morphy-Richards	4/-	15/6		50	20*	5 3 3	16/9	14/6
Murex	£1	54/9		20	20	7 6 3	57/6	53/3
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	2/7	2/3
Parnall (Yate)	5/-	14/3	+6d	12	12	4 4 3	14/3	5/9
Parsons, C. A.	£1	44/6		8¼	7¼*	3 7 6	53/6	43/-
Plessey	10/-	57/-x.d.	+9d	30	30	5 5 3	59/-	55/-
Pye "A" Deferred	5/-	12/6		12½	12½	5 0 0	13/9	10/-
Reyrolle	£1	77/6		17½	17½	4 10 3	84/6	73/6
Rheostatic	4/-	6/-		12½	12½	8 6 9	8/-	6/-
Richardsons Westgarth	10/-	14/-	−6d	16¾	8¼*	5 19 0	15/-	13/-
Scottish Cables	4/-	13/3		27½	27½	8 6 0	13/9	12/3
Simon-Carves	5/-	25/3		20	25	4 19 0	27/9	22/6
Smith (England), S.	4/-	8/6		17½	20	4 14 3*	8/6	7/-
Southern Areas	£1	10/-		7½	Nil	Nil	13/9	9/6
Strand Elec.	5/-	4/9		15	15	15 15 9	6/3	4/9
Sturtevant	5/-	14/9	−6d	15†	15†	5 1 9†	18/-	14/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	47/3
Switchgear & Cowans	5/-	11/6	+6d	25	22½	9 15 9	11/9	8/9
Taylor Tunnicliff	5/-	13/3		15	17½	6 12 0	13/9	11/9
T.C.C.	10/-	35/-		25	25	7 2 9	38/6	35/-
T.C. & M.	£1	23/6		8½	8½‡	7 4 9	27/-	20/-
Telephone Mfg.	5/-	5/3		10	10	9 10 6	5/3	4/6
Telephone Rentals	5/-	10/9		12½	12½	5 16 3	11/-	9/9
Thompson (John)	5/-	23/6x.d.		25	25	5 6 6	27/-	23/-
Thorn Elec. "A"	5/-	20/-		15	17½	4 7 6	20/-	17/-
Thornycroft	£1	25/6	−3d	12½	12½	9 16 0	27/9	21/-
Tube Investments	£1	55/-		13¾	15	5 9 0	55/-	48/3
Vactric	5/-	14/6		17½	25	8 12 6	15/6	14/3
Veritys	5/-	5/3		12½	12½	11 18 3	6/9	5/3
Walsall Conduits	4/-	13/6	+1/3	20	22½	6 13 3	14/3	11/-
Ward & Goldstone	5/-	28/6		35	40	3 10 3*	28/6	23/6
Watford	2/-	6/9		25	25	7 8 3	7/-	5/-
Westinghouse	£1	38/9		18	10*	5 3 3	38/9	32/3
West, Allen	5/-	11/6	+1/3	15	12½*	5 8 9	12/-	9/3
Wolf Electric	5/-	6/9		20	10*	7 8 3	9/-	6/9

Walsall Conduits Results

Expectations were very well satisfied by the final dividend and the preliminary profits statement of Walsall Conduits. Having moved up to 12s 9d in advance of the announcements, the official quotation of the 4s shares was subsequently advanced further to 13s 6d, and shares changed hands in the market up to 14s 9d. For 1957 the dividend is being made up to a total of 22½ per cent, or 2½ per cent more than before, so that the yield on the shares is improved to over 6½ per cent. Dividends appear to involve the distribution of under one-third of the net profit, which came out some £18,000 higher at £337,000, despite an increase in the tax charge to £375,000, and despite also the warning given in last year's report of contracting profit margins in the industry.

Company News

The £1 shares of W. H. Allen, Sons & Co. were quoted 1s 3d higher, at 36s 3d, following the decision to raise the dividend from a total of 10 to 11 per cent. This again represents a very conservative distribution of the net surplus, which improved in 1957 to nearly half a million, after tax. W. T. Henley's Telegraph Works 10s shares were a little easier, at 11s 6d, after the annual meeting, at which the chairman advised shareholders that this year's continuation of the same rate of dividend should not be taken as a guarantee that it would be maintained in future. On the question of a merger between the company and Johnson & Phillips, he indicated that it was still too early to give any definite information about the likely outcome of the talks in progress.

Avo, Ltd.

The financial year of Avo, Ltd., ended last March, and the 2s shares have been attracting interest lately, at a price of approximately 6s, in anticipation of the results, which will be the first to be published since the introduction of the shares to the Stock Exchange nearly a year ago. At that time, the prospectus foreshadowed for 1957–58 a dividend of not less than 20 per cent, the cost of which would be well within the surplus earned in the previous year. In March, the company declared an interim payment of 12½ per cent, which has of course encouraged expectations of a total not below 25 per cent. At that rate there would be a yield of over 8 per cent on the shares. Issued ordinary capital is £250,000.

REPORTS and DIVIDENDS

W. T. Henley's Telegraph Works Co., Ltd.—Sir John Dalton (chairman) presided at the annual meeting held on 6th June, and in the course of his review of 1957 said that the year had been a difficult one. Although the company had an excellent turnover, profit margins declined due to higher costs and lower price levels resulting from keener competition both at home and abroad. Additionally, the hampering effect of monopoly legislation was felt more acutely. For the second year running they had found it necessary to draw upon the reserve built up to alleviate the effect of the loss sustained through the fluctuations in the price of copper. Over the year, the price fell from £267 per ton to £181 10s per ton. They had also had to face certain abnormal expenditure. The disposal of Henley's Tyre & Rubber Co. incurred expenditures of a non-recurring nature, in particular the restoration of the Tyre Co. factory for the other uses to which they intended to put it. They had also had to face compensation to staff and employees of the Tyre Co. who could not be transferred or absorbed. They had already re-equipped part of the Tyre factory for production of their engineering business.

Sir John referred to the formation of Henley-Simplex Africa (Pty.), Ltd., jointly and equally owned by Henley's and the Simplex Electric Co. (S.A.) Pty., Ltd., and the benefits to be derived from the merger of the South African companies. Major-General Sir Francis de Guingand—who was chairman of the Simplex Co.—was chairman of the new company and Mr. R. Lord, Henley's local director and general manager in South Africa, had become deputy chairman. Expansion of Henley Foundries, Ltd., their other subsidiary, was well in hand and during the year the tonnage of castings delivered was nearly 10 per cent higher than for the previous year. The profits had continued to increase satisfactorily.

Regarding the conversations which were taking place between the boards of Henley's and Johnson & Phillips, Ltd., with a view to examining a basis upon which the businesses of the two companies might be merged, these were yet in the early stages but were still proceeding.

Sir John reminded stockholders of the contract received in 1957 from the British Transport Commission for oil-filled cabling for the electrification of the Kent Coast railway lines. Schemes in course of development for the modernisation of the railways embraced plans for further electrification of the track, in which they hoped to participate. In addition to a contract worth £500,000 from the United Kingdom Atomic Energy Authority for a power station in the north, they had many other contracts on hand valued at many hundreds of thousands of pounds from the electricity authorities. During the year they received the largest contract the company had ever obtained for steel tower transmission lines, involving 96 miles of 275 kV supergrid line between Harker and Penwortham in the Lakeland and Carlisle areas; the value was approximately £1,800,000. During 1958 they would be commencing work on other contracts, including 132 kV oil-filled cabling at Littlebrook power station.

The value of work received during the year by the Contract Department was an all-time record. An indication of the increased output of the cable factory at Gravesend was that the tonnage leaving the factory during 1957 was nearly 10 per cent above that for the previous year. So far as rubber and thermoplastic cables were concerned, the total value of sales was somewhat lower than in 1956, but this was mainly due to the reduction in prices, and so far as volume of business in these cables was concerned, 1957 showed a slight increase as compared with 1956. They had continued to secure valuable business for ship-wiring cables and for aircraft cables. The business of the Engineering Department, producing distribution accessories, had established new records. With the tendency for the Commonwealth countries to become more self-supporting in cable production, the pattern of their export business had been undergoing considerable change. They had sought out new territories and last year supplied goods to no fewer than 112 countries, including dollar-earning markets.

Sir John referred to some of the more important contracts secured last year, mentioning in particular the h.v. ring main cabling contract for the Orlando non-European areas, placed by Johannesburg City Council, and of stage II of the 88 kV cabling of the Kelvin power station. A valuable contract for feeder and distribution schemes for the Pakistan Government had been secured in connection with sites being developed at Kharian under the American Aid Plan, whilst in Australia their contract organisation secured a contract valued at £150,000 in connection with the cabling of the Morwell power station.

Turning to technical development and research, Sir John referred to the new range of "Tersil" cables for aircraft and their collaboration, at the request of the Admiralty, in the development of new silicone rubber cables for use in H.M. ships. With regard to the future, Sir John said that the large-scale expansion of the cable industry which had taken place since the last war had resulted in excess capacity which, in the present state of world demand, could not be fully employed. The curtailment in profit margins had occurred at a time when industry had had to build up reserves in order to be self-financing and meet demands for expenditure to keep pace with technical developments, many of which were necessary due to the introduction of new materials. Thus there was a tendency to stimulate a degree of rationalisation in the industry, with the object of securing maximum economies in production, administration and selling. Sir John concluded by announcing his retirement as chairman of the company, and the appointment of Sir Alexander Sim as chairman, following the meeting. Sir John said that he would remain a director of the company.

Elliott-Automation, Ltd.—The main figures in the accounts for 1957 were given in our issue of 2nd May. The company was formed in 1957 to merge Elliott Brothers (London), Ltd., and Associated Automation, Ltd. In his circulated statement, Mr. R. E. F. de Trafford (chairman) says that the group is to-day the largest and most broadly based organisation in the automation field outside the United States. Recently arrangements have been completed with Holtzer-Cabot, Massachusetts, in respect of small electric motors used in automation, and with C. P. Clare & Co., Chicago, in respect of specialised electrical relays. The long-term agreement with the National Cash Register Co., Ltd., is proving satisfactory. Orders for electronic computers, placed for the most part by them, form an important percentage of the expanding order book. As a consequence the increased requirements for manufacturing capacity in this field have necessitated the provision of new factory space, which Elliotts were able to secure on a site adjoining their present Borehamwood establishment. The erection of a new factory was commenced towards the end of last year and the first part of the building is already in use. For the current year the overall volume of orders received is satisfactory and the profits of the business as now constituted continue their upward trend. With the report and accounts the company has issued an illustrated brochure indicating the wide range of industries served by the group and of the processes covered.

The Southern Areas Electric Corporation, Ltd., will hold its annual meeting on 26th June. In his circulated review, Lord Gridley (chairman) says that in common with some other manufacturers of electrical and mechanical equipments of their range, they experienced a diminution in the order intake in 1957. The cuts in expenditure of Government Departments and the reduced requirements of some of their customers of long standing led to a fall in production just as they were in course of completing building extensions and plant additions at the Mawdsley Works

(*Continued on page 1141*)

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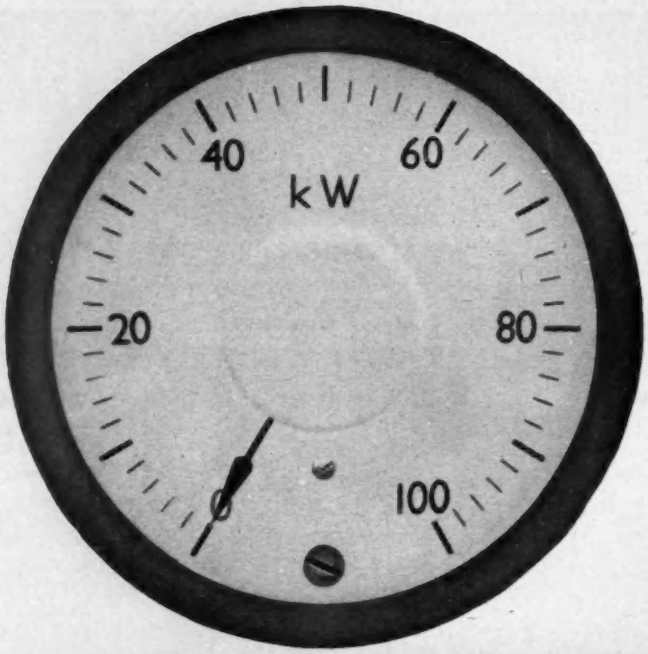

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FINANCIAL SECTION (*continued*)

(Dursley) and at some of their other factories. They have not yet received the orders they expected from the British Transport Commission for the Tyer Co. and they have in particular expended much time and finance in bringing up to date designs of automatic train control equipment and colour light signals to meet the modernisation programme. They still hope to receive a share of the orders yet to be placed. The New Day Electric subsidiary suffered substantial losses. Two main products of this subsidiary company are electric space heaters and immersion heaters, all subject to purchase tax. There is now hope that the reduction in the recent Budget of the 60 per cent tax to 30 per cent should before long encourage and increase the sale of domestic electrical appliances and ensure greater stability of business. In November last a serious fire caused considerable damage to the plastic works of the R.M.P. subsidiary at Birmingham. Production was quickly restored to about 50 per cent of normal, and later this year to about 80 per cent. It is not yet possible to assess the financial losses from the fire and other losses until all insurance questions have been dealt with. They may decide to dispose of this subsidiary if a reasonable offer should be forthcoming. Towards the end of the financial year they acquired the business of Designs & Installations, Ltd., Guildford. Mawdsley's have done further development work in connection with rolling mill drives. They have evolved a gearless variable speed motor for wire-drawing equipments and extended the applications of their stop-clutch motor. P.A.M. has done some promising research in the electronics field out of which has developed, *inter alia*, a magnetic amplifier and two types of electronic counter, one mains operated and the other transistorised. New Day Electric are providing new types of space heating equipment, including an inset fire.

Vent-Axia, Ltd.—The group profit for the year ended 31st March last amounts to £290,235, as compared with £245,636 for 1956-57, to which is added £1,974 taxation over-provision in previous years. From the total is deducted the following:—Taxation, £158,902; expenses re capital increase, etc., £6,644; capital redemption reserve fund, £1,867; general reserve, £79,800. It is proposed to pay a final ordinary dividend of 25 per cent (70 per cent), making 35 per cent for the year (100 per cent) on trebled capital. The balance carried forward is £16,077 (against £12,930 brought in).

J. Stone & Co. (Holdings), Ltd., reports a consolidated profit for 1957 of £1,438,313, as compared with £1,072,085 for 1956. Taxation absorbs £811,913 and the net balance is £626,400 (against £563,434). Reserves receive £350,000, and it is proposed to pay a final dividend of 14 per cent (against 12 per cent), making 18 per cent (16 per cent) for the year. The balance carried forward is £1,149,840 (against £1,108,921 brought in).

Metal Industries, Ltd.—The company is to offer its holding of 1,500,000 £1 shares in British Oxygen, Ltd., to its ordinary stockholders at 30s each in the ratio of one British Oxygen share for each three Metal Industries' shares held. Preference and ordinary stockholders will be able to apply for shares remaining available after all acceptances have been received. In a letter to the stockholders, Sir Charles Westlake, chairman of Metal Industries, emphasises the board's confidence in British Oxygen but says that its policy is to expand the group's interest as opportunities arise and it is held to be desirable to hold the group's funds in a form in which immediate advantage can be taken of any such opportunities. The offer should yield £2,149,000. It will also enable British Oxygen to add rather more than £1 million to its reserves.

Pena Industries, Ltd.—In the High Court on Monday last Mr. Justice Wynn-Parry adjourned for three weeks a petition for the winding up of this company presented by the company itself. For Pena Industries it was stated that its position was due to the sudden collapse of a banking company, Comcor, Ltd. Mr. Justice Wynn-Parry later made a compulsory winding-up order against the latter company.

Associated Electrical Industries, Ltd., proposes to create £25 million of 6 per cent debenture stock, 1978-83. Arrangements are in hand for the underwriting by Morgan, Grenfell & Co. of £21,550,000 of the issue, and holders of £3,450,000 of the 3¼ per cent ten year notes 1954-59 have agreed to convert their holdings into the new stock. The issue price will be £98 10s per cent.

W. H. Allen, Sons & Co., Ltd., report a net profit for 1957 of £496,655, as compared with £478,208 for the preceding year. The proposed final dividend is 8½ per cent (against 7½ per cent), making 11 per cent (10 per cent) for the year.

Walsall Conduits, Ltd., reports group profits for 1957 of £712,122, as compared with £663,709 for the preceding year. Taxation absorbs £374,844 and the net balance is £337,278 (against £319,166). A sum of £40,000 is placed to general reserve and it is proposed to pay a final dividend of 15 per cent (against 12½ per cent), making 22½ per cent (20 per cent) for the year. The balance carried forward is £930,778 (against £742,750).

Matthew Hall & Co., Ltd.—The annual meeting was held on 4th June, Mr. B. Baden (chairman) presiding. In the course of his circulated review of 1957 the chairman, in referring to the nuclear energy division, said that during the year they received orders for the installation of graphite moderators, instrumentation, fission product detection involving over 250 miles of stainless steel pipework, and other work at the new C.E.G.B. nuclear power stations. The work at Calder Hall and other atomic research stations still continued.

The Atlas Electric & General Trust, Ltd., has obtained the consent of the Capital Issues Committee to a one-for-fourteen scrip issue. This will capitalise £300,000 and will be made after payment of the interim dividend in December next.

R. A. Lister & Co., Ltd., have declared an interim dividend of 2½ per cent (unchanged).

Bankruptcies

V. Jackson, 311-313, Aigburth Road, Liverpool, electrical and radio engineer.—Receiving order made 30th May on debtor's own petition.

W. R. V. Salt, 232, Archway Road, Highgate, London, N.6, radio, television and electrical engineer.—Receiving order made 22nd May on debtor's own petition. Public examination 11th July at Bankruptcy Buildings, Carey Street, London, W.C.2.

G. G. Brittain, 1, Bromley Common, Bromley, Kent, radio and television electrical engineer.—Trustee, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2, appointed 22nd May.

G. W. South, trading as G. W. South & Co., at High Street, Navenby, Lincs., radio and electrical engineer.—Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham, Official Receiver, released 22nd May.

J. Summerly, 93, Mowbray Road, South Shields, electrician.—Trustee, Mr. N. Saddler, Clarendon House, Clayton Street West, Newcastle-upon-Tyne, 1, Official Receiver, released 27th May.

C. P. Wheeldon, of, and lately carrying on business at Bryn Awel, Brunswick Road, Buckley, and at 29-39, Mold Road, Buckley, Flints., electrical and general dealer.—Trustee, Mr. R. P. Booth, Kimberley House, 14-17, Holborn Viaduct, London, E.C.1, appointed 29th May.

Liquidations

P. D. Morris, Ltd., electrical engineers and contractors, 10, Garnault Mews, Rosebery Avenue, London, E.C.1.—Winding up voluntarily. Liquidators, Mr. W. J. Fraser, Broad Street House, Old Broad Street, London, E.C.2, and Mr. C. Metliss, 97 and 99, Park Street, London, W.1, appointed 29th May.

John Downton (Electric), Ltd. (in voluntary liquidation).—Particulars of claims by 30th June to the liquidator, Mr. D. H. A. Gray, Westminster Bank Chambers, Epping, Essex.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 21st June:—

TELEQUIPMENT. No. B756,951. Class 9. Pattern generators, waveform generators, oscilloscopes and monoscope signal generators, all being electronic instruments and apparatus used in the television industry.—Telequipment, Ltd., 313, Chase Road, Southgate, London, N.14.

MODACONNECTOR. No. 774,474. Class 9. Electrical connectors.—Modern Acoustics, Ltd., 2, Manor Way, Boreham Wood, Herts.

VERITANIA. No. 774,455. Class 11. Electric ventilating fans for tables, walls and ceilings, and parts.—Veritys, Ltd., Plume Works, Plume Street, Aston, Birmingham, 6.

FILAMIC. No. 767,093. Class 17. Electrical insulating materials.—Langley London, Ltd., 163-5-7, Borough High Street, London, S.E.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Brisbane Electricity Department. 5th September. One 60 MW turbo-generator and ancillary plant. (E.S.B. 14267/58. Ten/32770.)*

Burma.—Burma Purchase Board, Rangoon. 23rd June. Electric lamps and fittings. (E.S.B. 14544/58. Ten/32825.)* Radio chainlink insulators and valves. (E.S.B. 14543/58. Ten/32883.)*

Durham.—County Council. Electrical installation in Hurworth-on-Tees new modern school. (See this issue.)

Ely.—U.D.C. 27th June. Electrically driven pump with wet motor, together with equipment. John Taylor & Sons, engineers, Artillery House, Artillery Row, Westminster, S.W.1.

Gateshead.—Corporation. Applications to tender for electrical work at Shipcote Boys' Grammar School should be made by 18th June. (See this issue.)

Iran.—Iranian Telephone Co., Teheran. 19th June. 2,000 telephone sets. (E.S.B. 13915/58. Ten/32740.)*

Plan Organisation, Teheran. 12th July. Power station at Suzangard. (E.S.B. 14004/58. Ten/32758.)*

Korea.—Government Office of Supply, Seoul. 20th June. Equipment including four storage batteries and one battery charger. (E.S.B. 13928/58.I.C.A. Ten/32708.)* Thirty-five electrically driven centrifugal pumps. (E.S.B. 14396/58.I.C.A. Ten/32804.)*

Reading.—4th July. Corporation. Rewiring of installations at Kendrick Girls' School and West Wing, Reading School. (See this issue.)

Rhodesia and Nyasaland.—Umtali Electricity Department. 25th June. Two electrode boilers. (E.S.B. 14157/58. Ten/32734.)*

Bulawayo Electricity Department. 16th July. Twelve 300 kVA and twelve 500 kVA transformers. (E.S.B. 14593/58. Ten/32843.)*

Staffordshire.—County Education Committee. 28th June. One ionisation pressure gauge, two cathode ray oscillographs and one 6-anode mercury arc rectifier for County Technical College. (See this issue.)

Strabane (Co. Tyrone).—27th June. Electrical installations at voluntary school for boys, Melmount. Varming & Mulcahy, consulting engineers, 37, Malone Road, Belfast.

Thailand.—Railways Organisation. 8th August. Ten diesel railcars. (E.S.B. 14345/58. Ten/32778.)*

Uxbridge.—The Group Hospital Management Committee invites applications by 30th June from electrical contractors for inclusion of their names in the Committee's approved list of contractors. Applications to Mr. W. E. Bardgett, group secretary, Uxbridge Group, The Furze, Field Heath Road.

ORDERS PLACED

Durham.—County Education Committee. Electrical work at Billingham Low Grange Junior School (£2,678).—Edmundsons Construction Co. Annfield Plain Modern School (£1,017).—T. Kitcheman.

Isle of Ely.—County Council Education Committee. Accepted. Electrical installation at the Whittlesey New Junior School (£2,785).—Bowers & Barr, Ltd.

Newcastle-on-Tyne.—Electrical installation in new library for King's College.—N. G. Bailey & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldershot.—Five shops and fifty-six flats, North Town; Godalming Building & Construction Co., Ltd., Langham Estate, Godalming.

Annan.—Houses (38), Newington; J. A. Bent, Scottish Special Housing Association, Ltd., Palmerston Place, Edinburgh, 12.

Barnard Castle.—Houses (40); U.D.C. surveyor.

Basildon.—Factory for Carson Bros. (Productions), Ltd.; Hosking & Son, Ltd., builders, Arterial Road, Rayleigh.

Bedford.—Reconstruction of Newnham Baths (first stage to cost £59,800); borough engineer.

Bedlington.—Houses (60), Morpeth Road; U.D.C. surveyor.

Berkhamsted.—Houses (80), Westfield estate; D. T. Thorne, clerk, Civic Centre.

Bootle.—Methodist church and hall, Gorsey Lane; J. C. Prestwich & Son, architects, Bradshawgate Chambers, Leigh, Lancs.

Bristol.—Shops, Lower Castle Street, to replace temporary premises; John Laing & Son, Ltd., building contractors, Bunns Lane, London, N.W.7.

Bucks.—Science block, Wycombe Royal Grammar School (£75,000); county architect, County Offices, Walton Street, Aylesbury.

Chwilog.—Cheese factory; South Caernarvon Creameries, Ltd., Four Crosses.

Coalville.—Maternity hospital; Sheffield Regional Hospital Board, Fulwood House, Old Fulwood Road, Sheffield, 10.

Cobham.—Thirteen shops and flats, London Road; Eagle Construction Co., Ltd., Cranleigh Close, Sanderstead.

Cookham.—Houses (58), White Waltham; A. Mandeville, R.D.C. surveyor, 1, Bath Road, Maidenhead.

Corby.—Shops, flats and garages, Woods End estate; Development Corporation, Fineshade Abbey, Duddington.

Cornwall.—County secondary school, Helston; county architect, County Hall, Truro.

Corsham.—Houses (100) for Admiralty employees; surveyor, Bewley House, Marshfield Road, Chippenham.

Crawley.—Works and offices; Beric Press, Ltd., 116, Victoria Street, London, S.W.1.

Dagenham. — John Preston Secondary Modern School; S. R. Bryett, Ltd., builders, Church Elm Lane.

Dover. — R.C. school, Barton Road (£108,785); E. T. Ashley Smith, county architect, Springfield, Maidstone.

Durham.—Houses (20) for R.D.C.; J. F. Willis, housing architect, Byland Lodge, Durham.

East Kesteven.—Houses (56) for R.D.C.; surveyor, 14, Northgate, Sleaford, Lincs.

Eccles.—Eight-storey block of flats, Barlow Street; borough surveyor.

Enfield.—Referring to the note in our 30th May issue, Messrs. Harding, McDermott & Partners, electrical, heating and ventilating consultants, point out that their correct address is 17 (not 18), Doughty Street, London, W.C.1.

Esher.—Housing development on estate in Farm Road; clerk to U.D.C., Council Offices, High Street, Esher, Surrey.

Frimley.—Rebuilding Burrow Hill School (£158,500); H. Bennett, Architects' Department, County Hall, Westminster Bridge, London, S.E.1.

Gelligaer.—Houses (128), Trelewis; U.D.C. surveyor, Council Offices, Hengoed, Glam.

Gravesend.—Flats (104), Park Place; Carlton Contractors, Ltd., Carlton House, Ashley Road, Epsom.

Halifax.—X-ray department for General Hospital; Leeds Regional Hospital Board, Park Parade, Harrogate.

Hartley Wintney.—Police training college, Bramshill; Wilson, Lovatt & Sons, Ltd., 16, Grosvenor Crescent, London, S.W.1.

Hatfield.—Major extension scheme, Technical College (£114,300); Herts. county architect, County Hall, Hertford.

Hensingham.—County secondary school and junior school; J. H. Haughan, county architect, 15, Portland Square, Carlisle.

Heston and Isleworth.—Houses and flats (14), Ivy Lane/Staines Road site; borough engineer, 88, Lampton Road, Hounslow.

Hetton.—Private housing estate at Four Lane Ends; G. M. Pearson & Son, builders, Front Street, Hetton, Co. Durham.

Hornsey.—Flats (95), Tottenham Lane; Clifford Culpin, architect, 39, Doughty Street, London, W.C.1.

Ipswich.—Houses (34), Chantry estate; Macro, Ltd., builders, Pine Avenue.

Leek.—County secondary modern school, near Westwood Hall; director of education, Green Hall, Lichfield Road, Stafford.

Leicester. — Large extensions to Lero College of Technology, off Belgrave Gate, for E.C.; J. H. Lloyd Owen, city architect, 10, Loseby Lane.

London.—Houses (30), Gill Street scheme, Stepney; borough engineer, Municipal Offices, 227/33, Commercial Road, E.1.

Office block, Coleman Street, E.C.; Myton, Ltd., builders, 10, Park Street, W.1.

Factory, Boston Manor Road, Chiswick; W. V. G. Engineering Co., 329, High Street, Brentford.

Manchester.—Works extensions; Saxon Jefferis, Ltd., Wilmslow Road.

Newcastle-on-Tyne.—Houses, Waverdale Avenue (20) and Scrogg Road (15) and 12 flats in Walker Road; city architect, 18, Cloth Market, Newcastle-on-Tyne.

Oxford.—Shops, Cowley; H. Cooper & Sons, surveyors to Council, 51a, Cornmarket Street, Oxford.

Portsmouth. — Showrooms, Commercial Road; John Temple, Ltd., Angel Road, London, N.18.

Southall.—Shops and maisonnettes, Lady Margaret Road; Norman Sinclair, Ltd., builders, Denmark House, Denmark Road, London, W.13.

Stevenage.—College of Further Education (£278,000); C. H. Aslin, county architect, County Hall, Hertford.

Swansea.—Showrooms for Plaza Motors, Ltd.; Cyril A. Hughes & Son, architects, 51, Walter Road.

Tipton.—Eleven shops and 15 flats and maisonnettes, Union Street; borough surveyor.

Tottenham.—Dwellings (39), Gaywood's Factory Lane; borough engineer, Town Hall, N.15.

Tyldesley.—Houses (52) and two blocks of old people's dwellings, Shakerley site; R. F. Wilson, clerk to U.D.C., Town Hall.

Worcester.—Girls' grammar school; Hoare, Lea & Partners, electrical and heating consultants, 52, Green Street, London, W.1.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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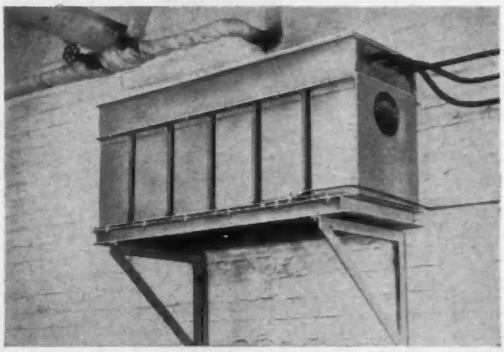

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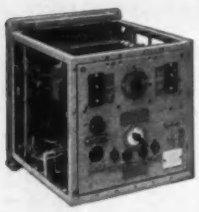

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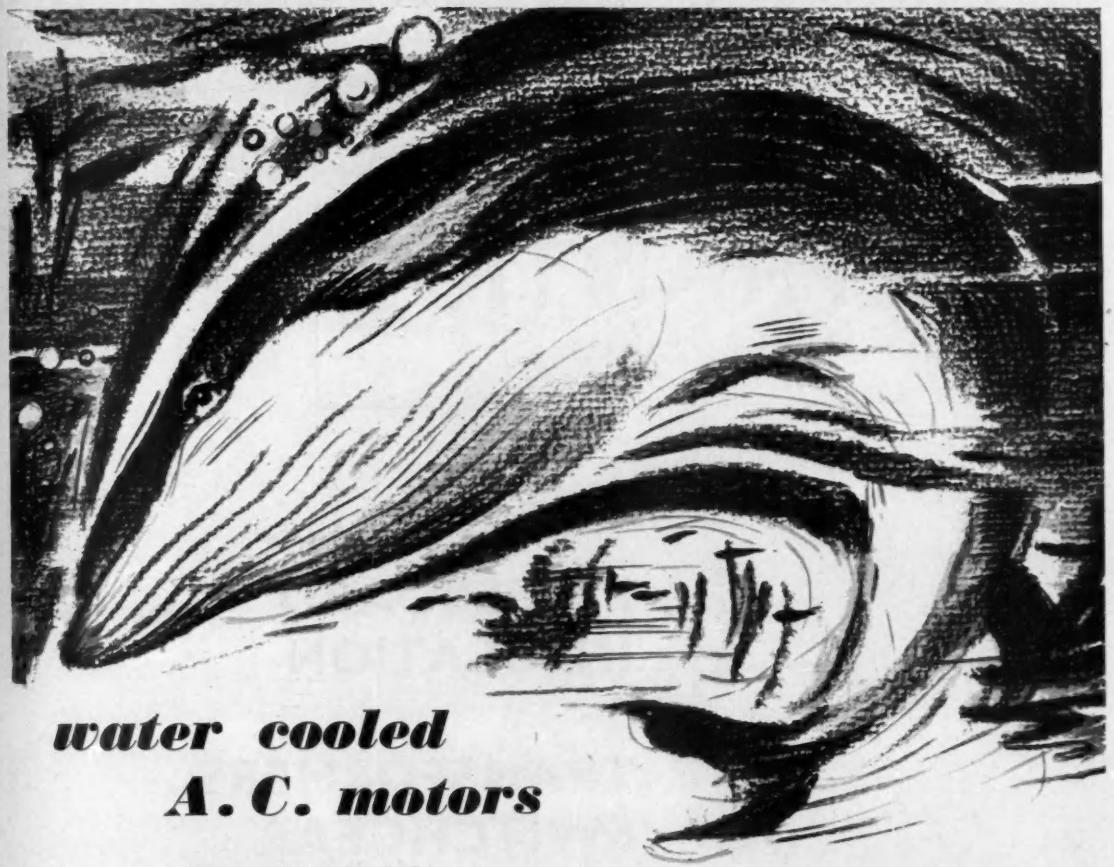

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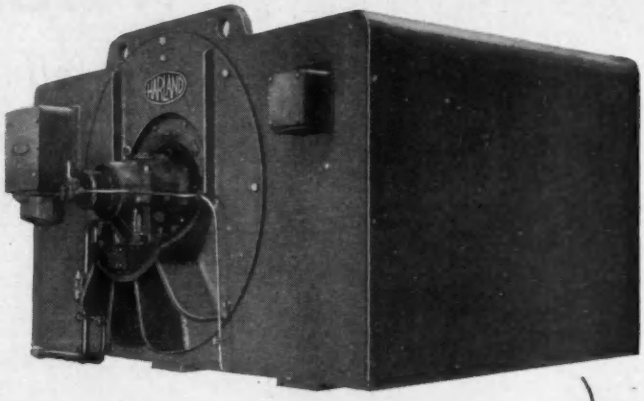

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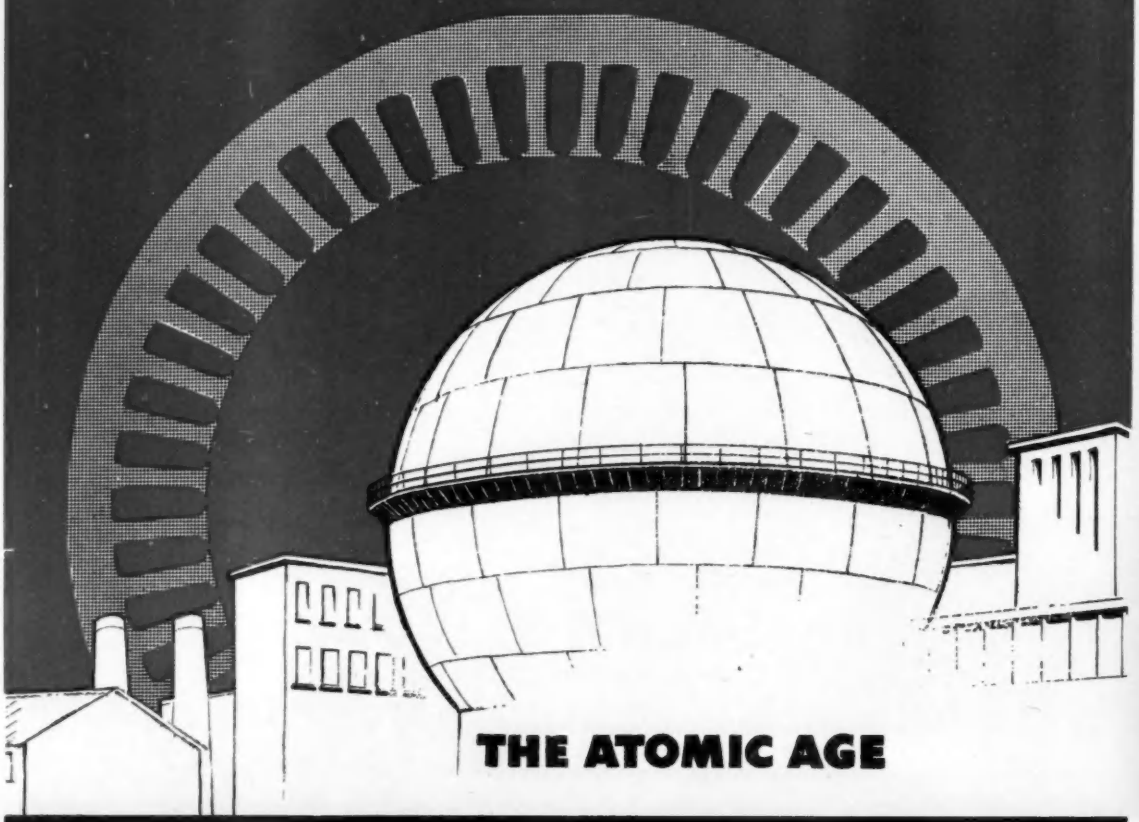

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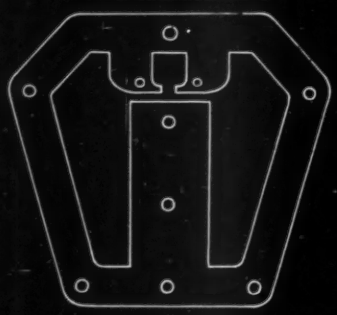

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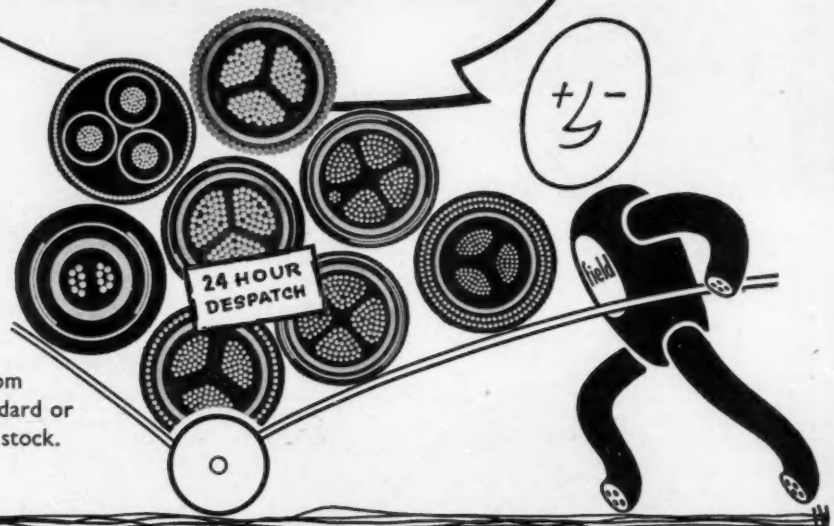

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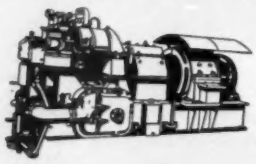

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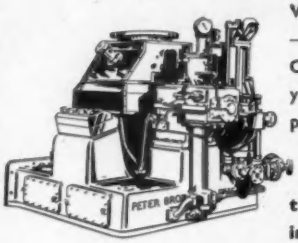

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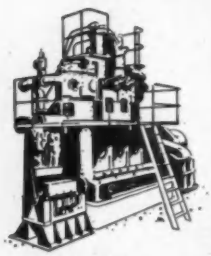

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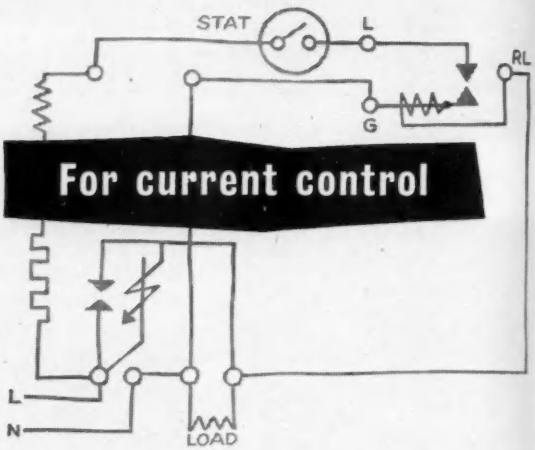

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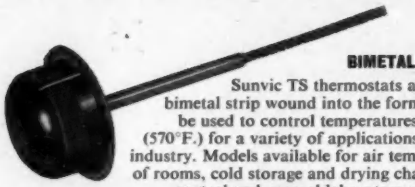
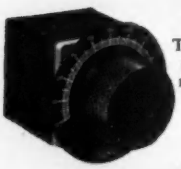
Sunvic components are widely used for controlling equipment such as moulding presses, furnaces, incubators, chemical plant, etc. Together with the Sunvic potentiometric recorder they also have numerous applications in scientific and industrial research particularly for measuring, controlling and recording temperature and small electrical quantities.

If you have a specific problem or would like technical information on any or all Sunvic components, please contact Sunvic Controls Ltd., P.O. Box 1, Harlow, Essex. Tel: Harlow 25271.



ADJUSTABLE BIMETAL THERMOSTATS

Sunvic TS thermostats are operated by a bimetal strip wound into the form of a helix. Can be used to control temperatures of up to 300°C. (570°F.) for a variety of applications in research and industry. Models available for air temperature control of rooms, cold storage and drying chambers, for oven control and general laboratory work, and with a sensitivity of ±1/10°C. for very accurate control.



ENERGY REGULATORS

The Sunvic energy regulator effects its control by periodically switching on and off the power, the ratio of the on-time to the total time determining the average power input, which is continuously variable. Available in several forms with a continuous rating of 1kW at 230V. A.C.; also supplied with an HVS relay for larger loads.

HOTWIRE VACUUM SWITCH (HVS) TUBES AND RELAYS

Available either as a loose tube for switching up to 10 kW at 400V. A.C. or D.C. or as a complete relay either enclosed in a plastic box or mounted on a paxolin base for incorporation in customer's own equipment. For single—or three-phase A.C. applications. Advantages are: no arcing; silent operation; low, non-inductive operating current; A.C. or D.C.; inductive or non-inductive loads.

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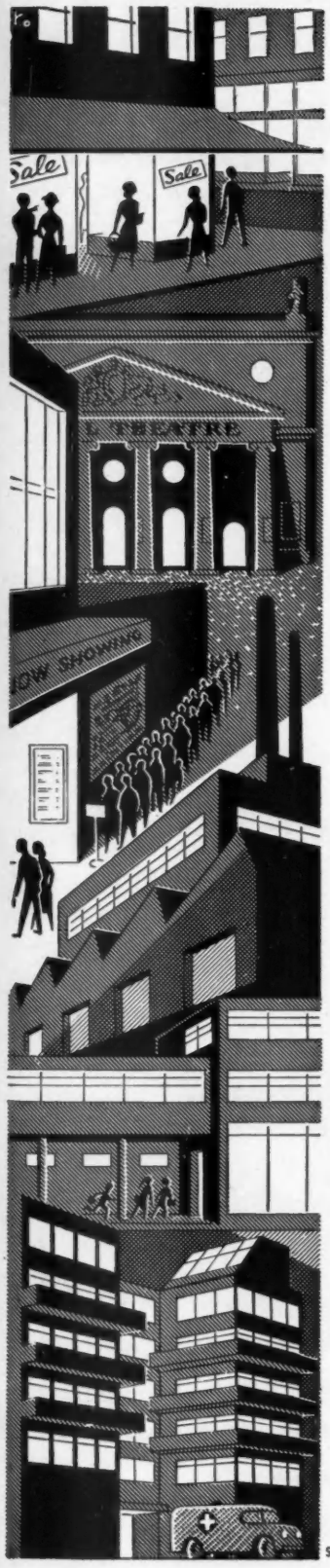

Every other day

THERE'S NO GLAMOUR about emergency lighting. No social prestige, either. All over the country, tens of thousands of ambitious young husbands are definitely *not* saying, 'Darling, the very next time the boss raises my salary, we'll install emergency lighting.' Until they get round to becoming responsible for such concerns as Banks or Hospitals or Cinemas or Big Stores or Dance Halls or Art Galleries or Power Stations, they won't need it.

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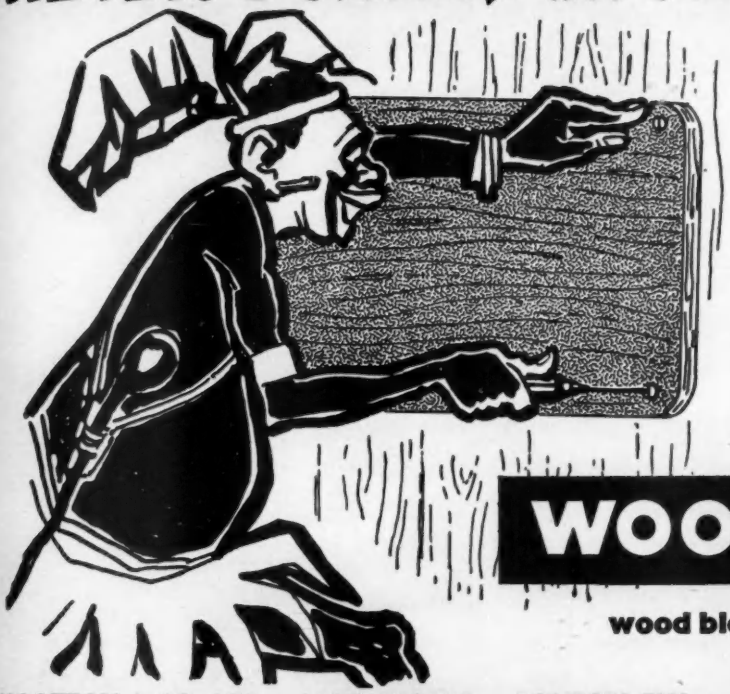

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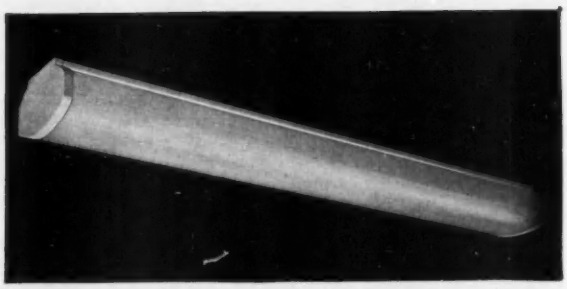

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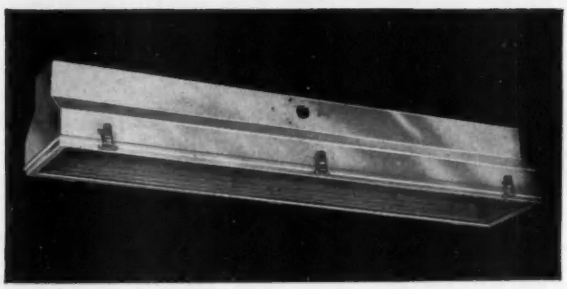

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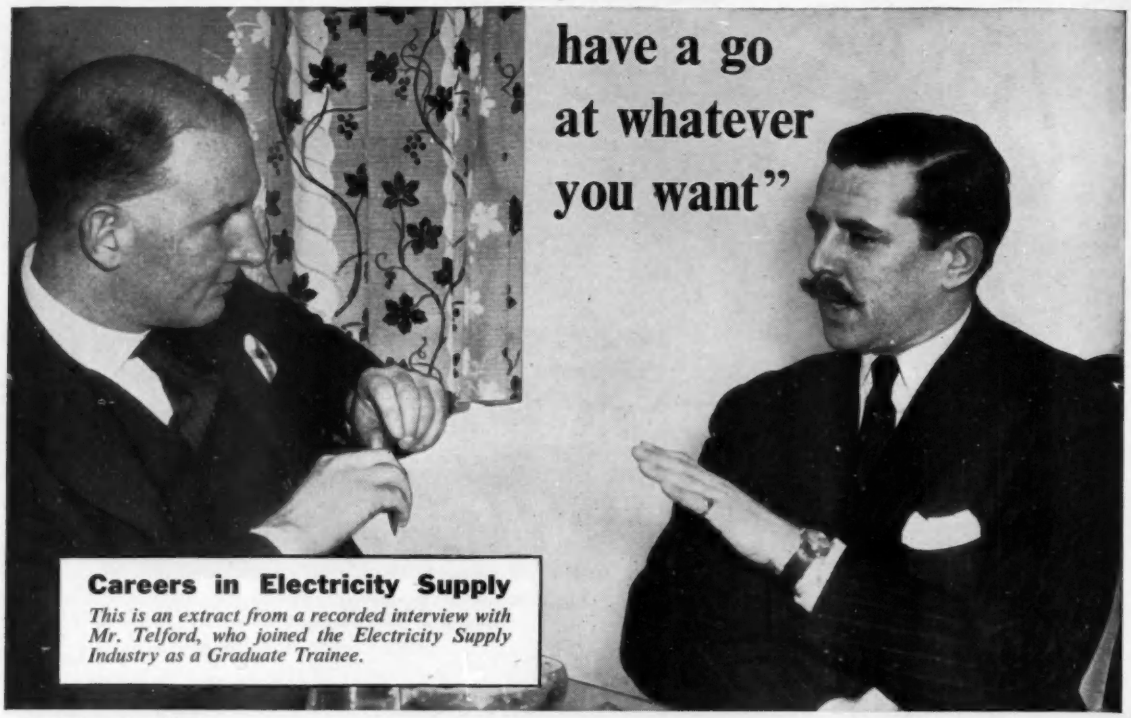


Careers in Electricity Supply

This is an extract from a recorded interview with Mr. Telford, who joined the Electricity Supply Industry as a Graduate Trainee.

E.S.I. Question Master — *Mr. Telford.*

Question Master: **I think we might begin by asking what was your first job in Electricity Supply after your training was finished?**

Mr. Telford: Well, my training was interrupted by the war, and it was only in 1950 that I finished my graduate course in the industry. I was then appointed Shift Charge Engineer at Frome, Somerset—a small station but an excellent training ground. From there I went to Earley—a much bigger station of 120 megawatts—as Boiler House Shift Engineer; later I became Charge Engineer there, and for a while was Efficiency Engineer, as well.

Q.M.: **Your next step was London, wasn't it?**

Telf: Yes, I came to London as Second Assistant Engineer on the Divisional Staff, and later I was appointed Deputy Superintendent at Bankside Generating Station—the position which I hold now.

Q.M.: **Bankside is a pretty big station, and at 36 you're young, aren't you, to be a Deputy Superintendent? But what made you come to London in the first place?**

Telf: A chance came along to get some administrative experience at H.Q. level, and I thought I'd better take it.

Q.M.: **Does the Industry give many opportunities like that?**

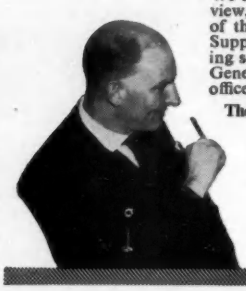
Telf: It most certainly does. It gives you a complete opportunity to have a go at whatever you want, and what you think you're best equipped for. The man who wants to get on is helped in every possible way; I've attended several courses run by the Industry, not only on technical matters, but on subjects like personnel selection and industrial relations.

Q.M.: **You find your job gives you scope for managerial ability—dealing with people as well as machines?**

Telf: Yes, indeed. I don't think there are many better opportunities than in a power station, because you have something of everything. You have the mechanical side, the electrical side, the building side—and most of all, a number of people with varied interests and jobs.

Q.M.: **Now a word about newcomers to the industry. If you have a chap of ability who is prepared to get down to the task, what would you say his opportunities were like?**

Telf: I would say that he has really splendid opportunities. For one thing, a career in the industry is established on a very firm footing—you could do without a lot of things, but it's impossible to get on nowadays without electrical energy. Another point worth remembering is that a man coming into the industry has the choice of the entire country to work in, and there's no parochial approach.



We'd like to publish more of this interview, but there isn't space. For details of the many careers in the Electricity Supply Industry and the salaried training schemes available ask at your local Generating or Distribution Board's offices, or write direct to:

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The Electricity Council,
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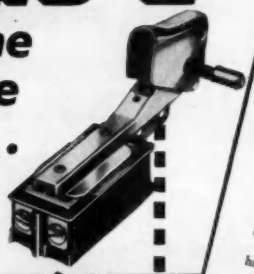

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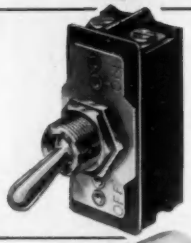

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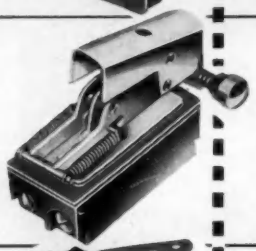

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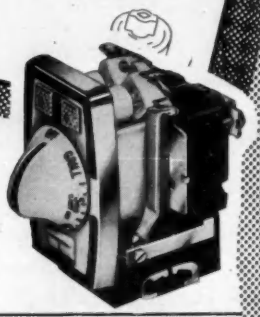

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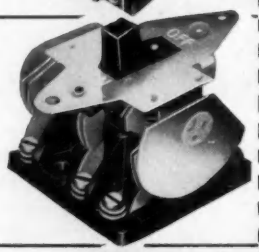
25 amp. 250v. triple pole ON/OFF toggle Switch for bench grinders, wood-working machines etc.



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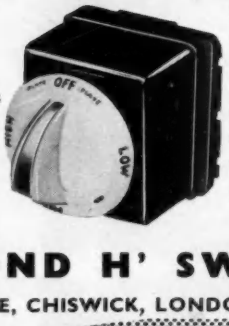

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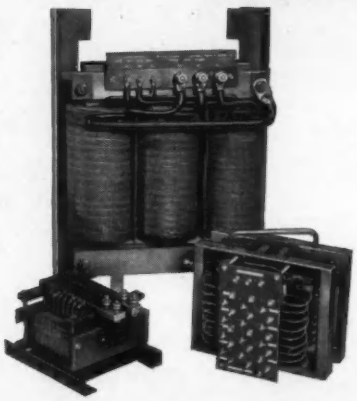

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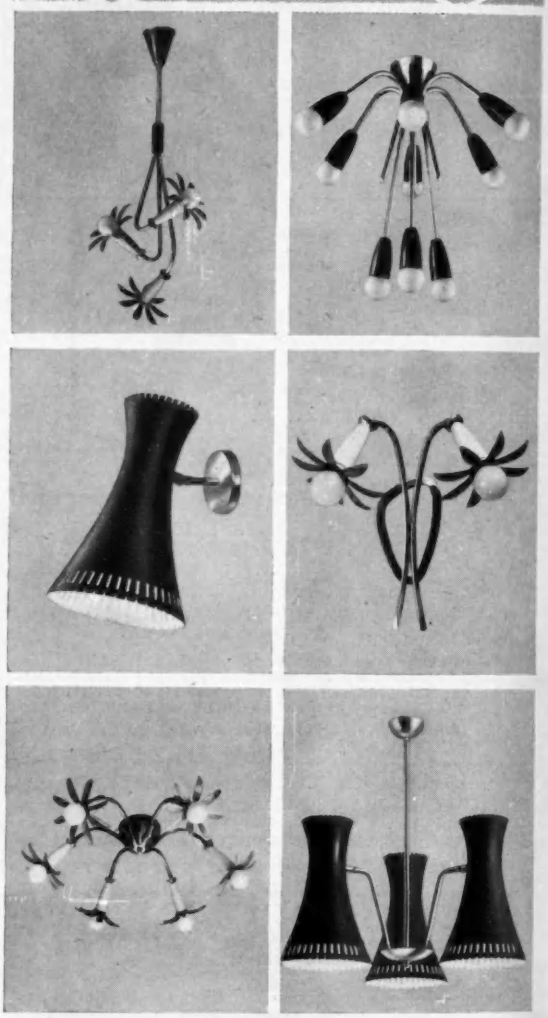

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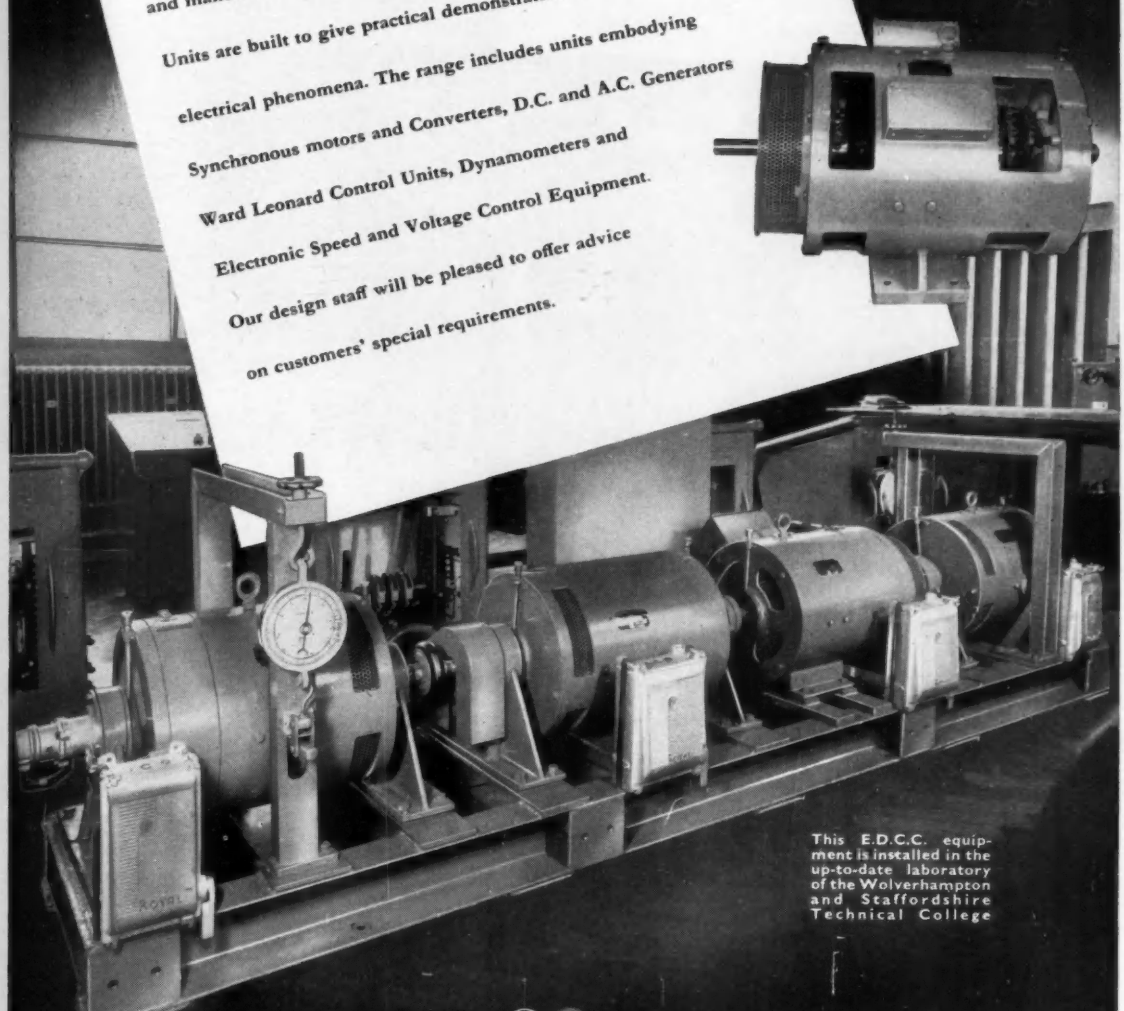

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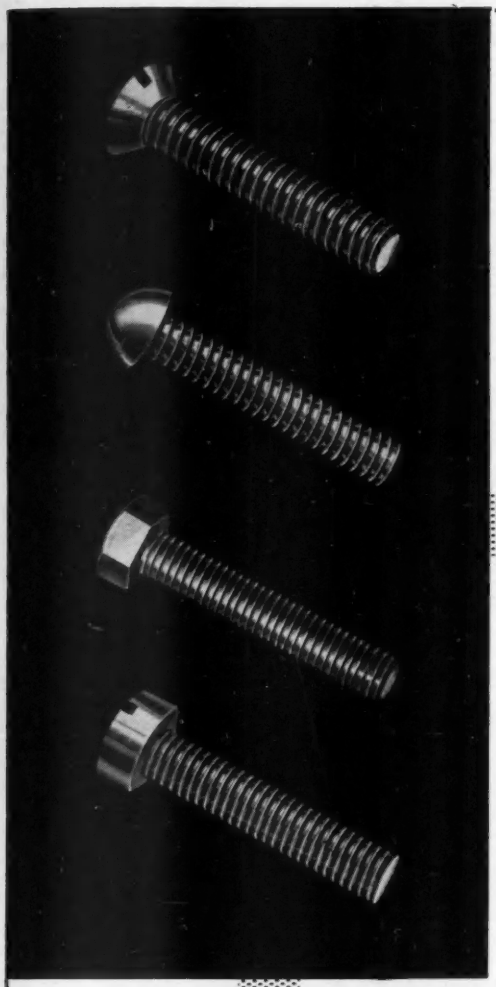

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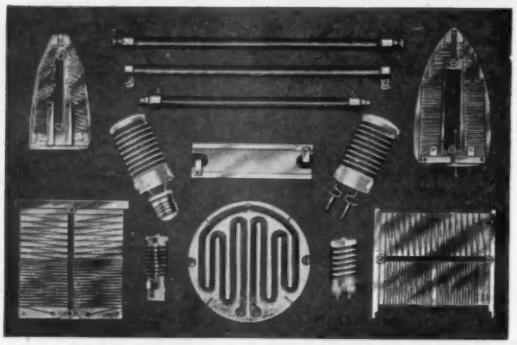

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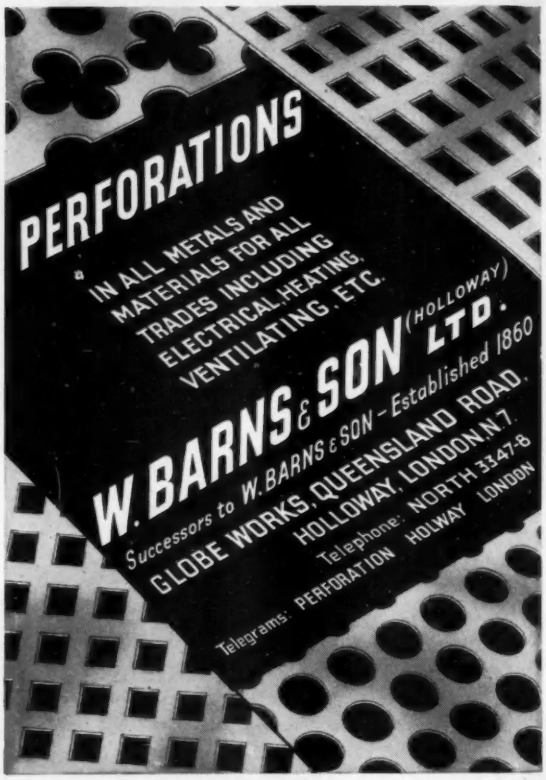
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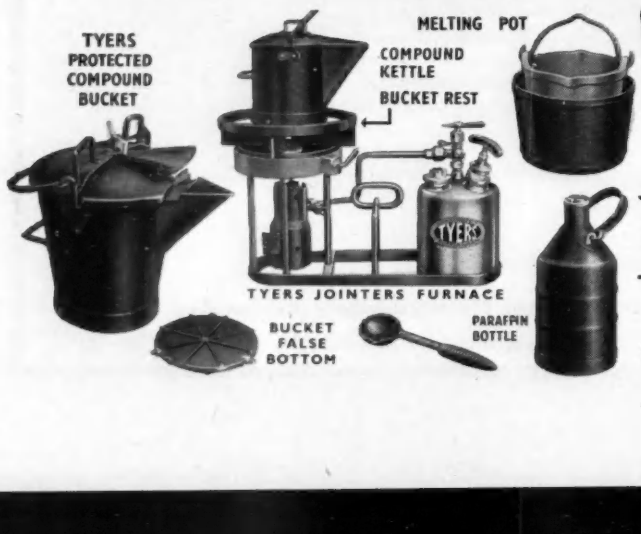

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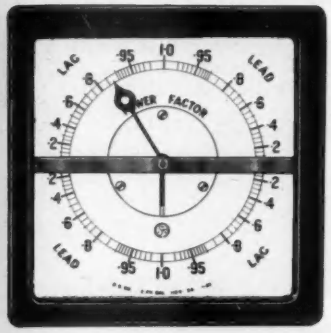

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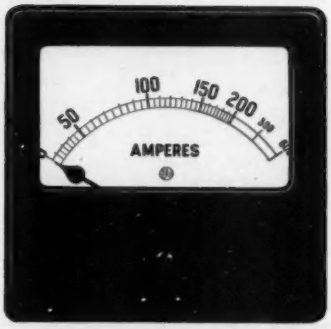

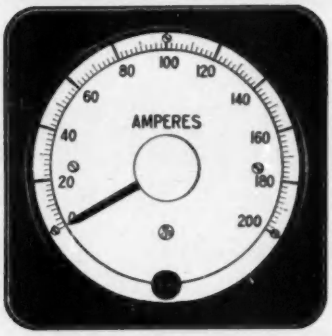

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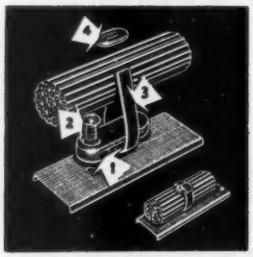

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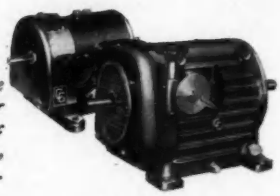

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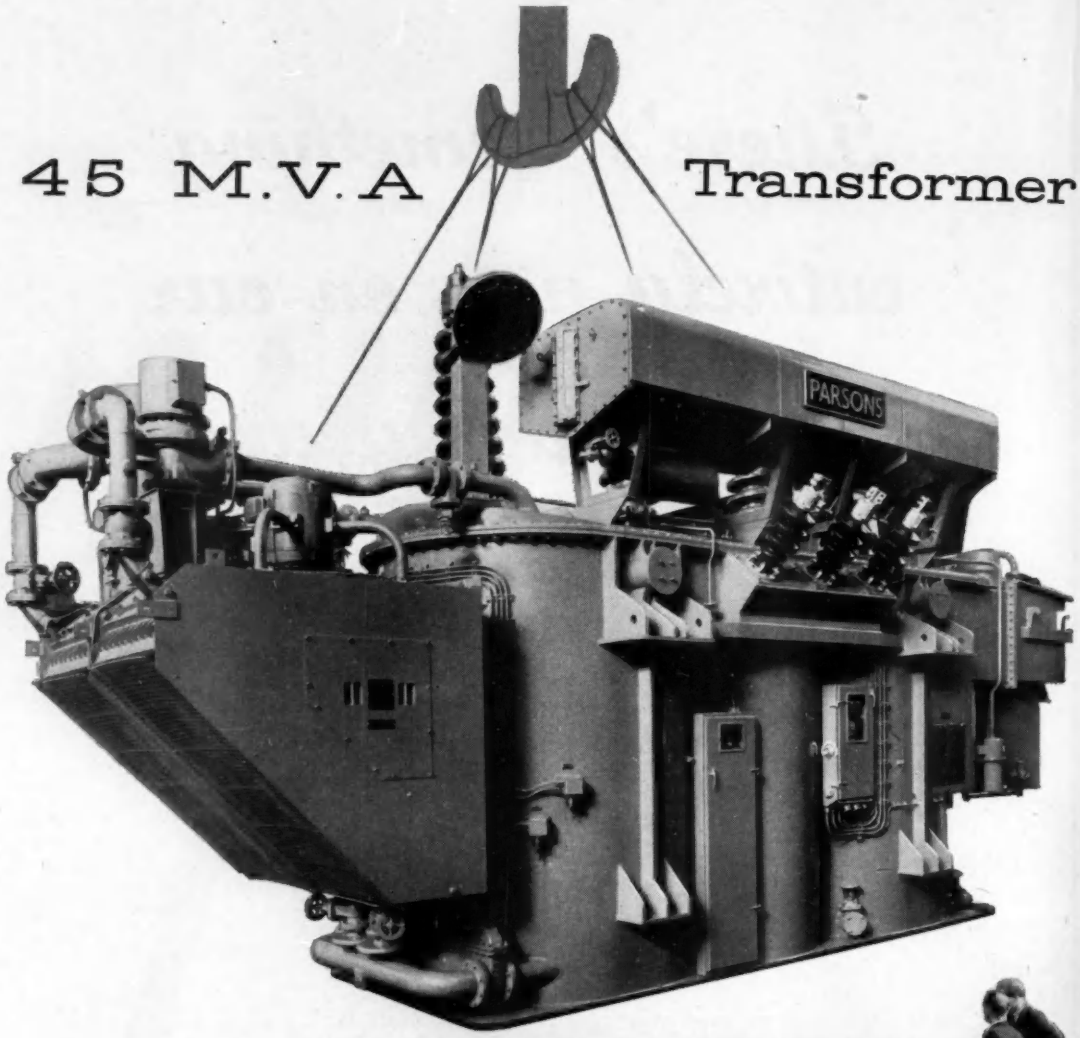

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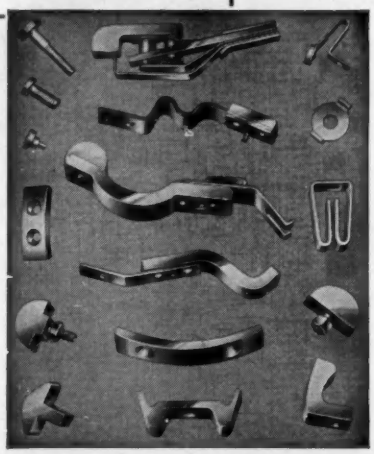

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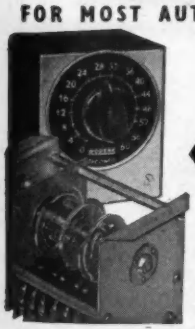

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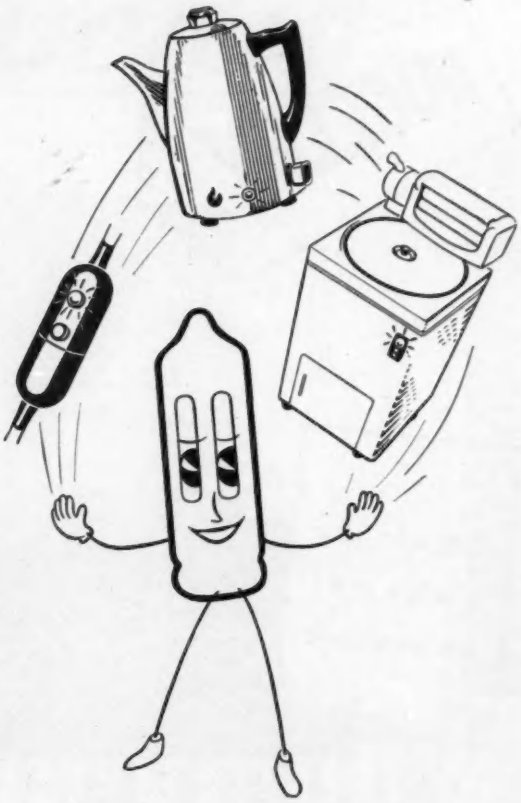

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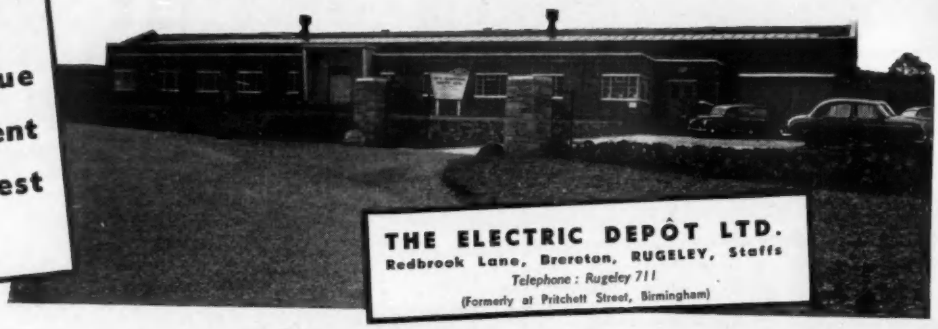

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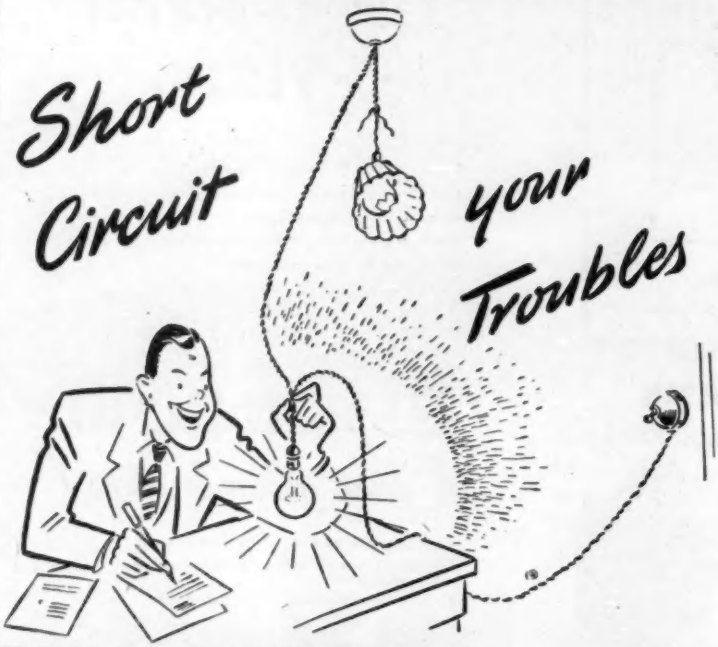

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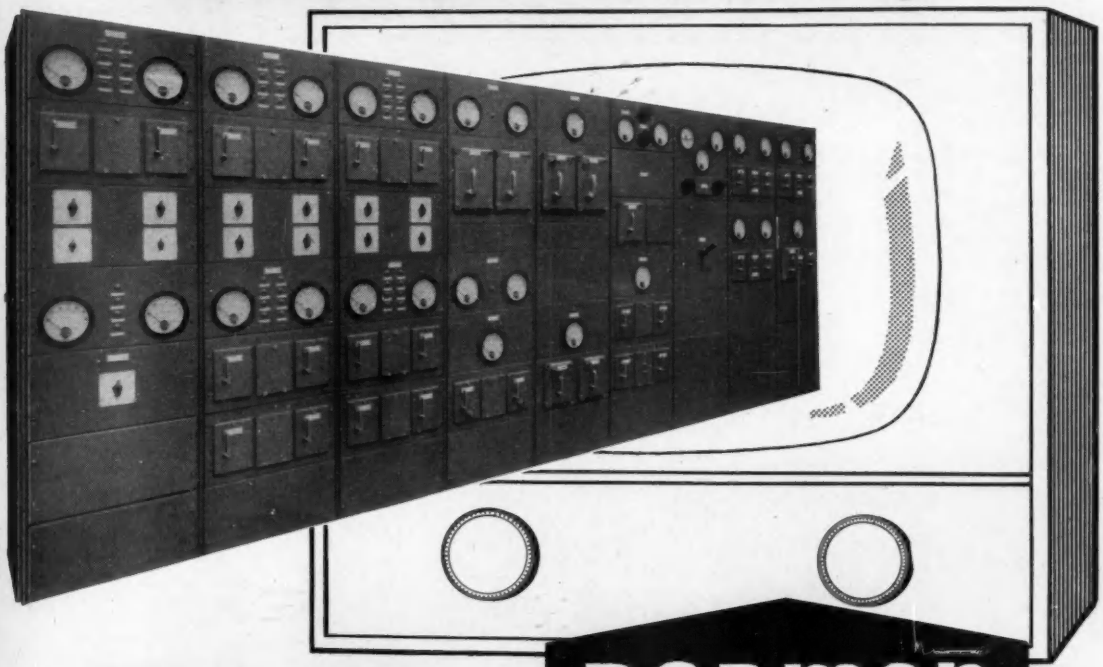

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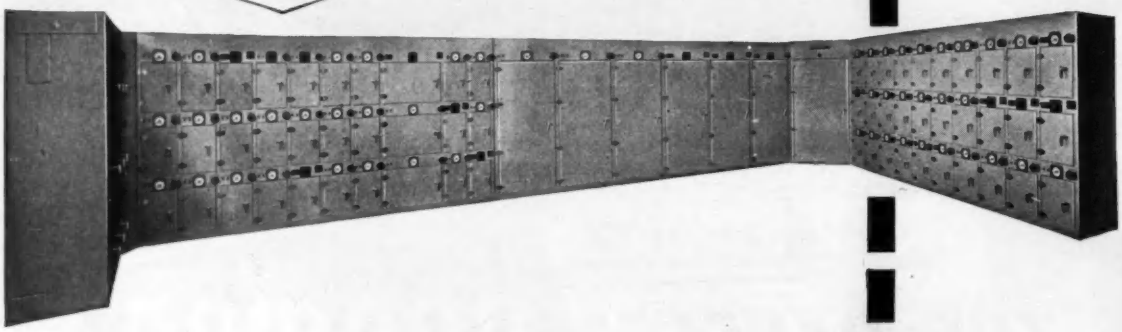
—all controlled from one central panel



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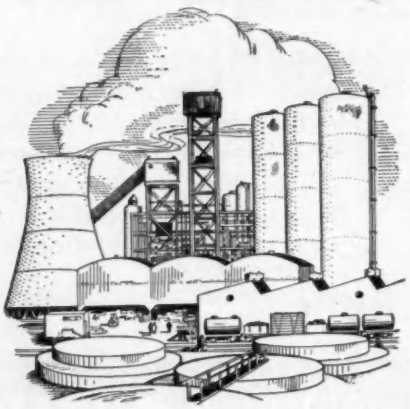

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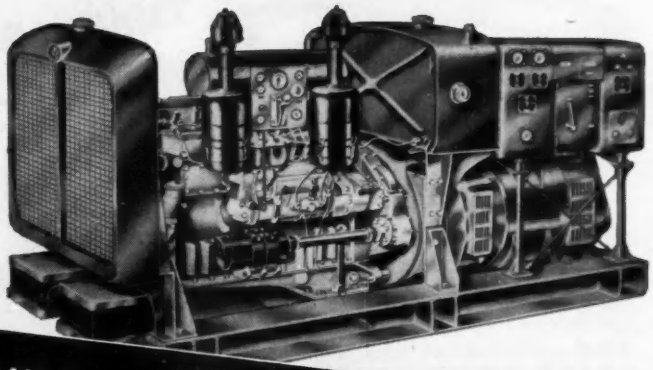

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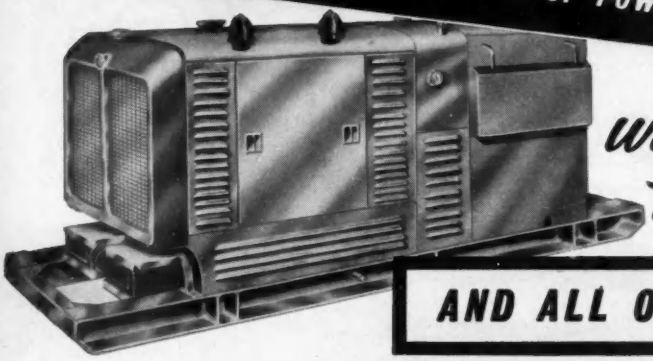

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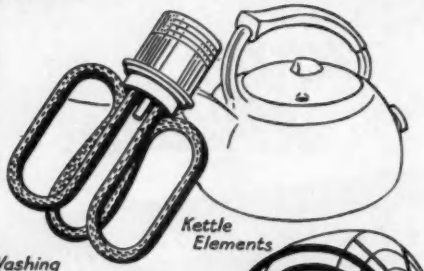
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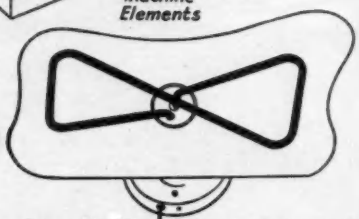
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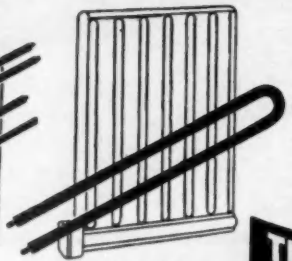
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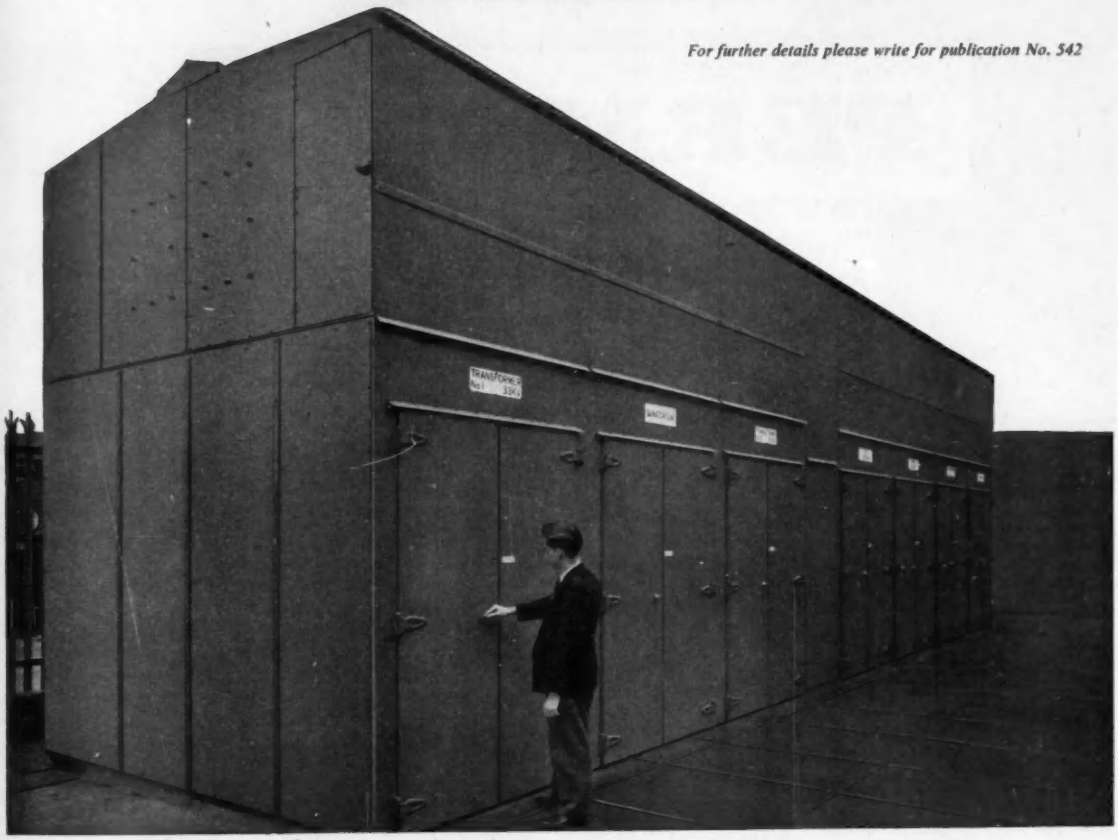

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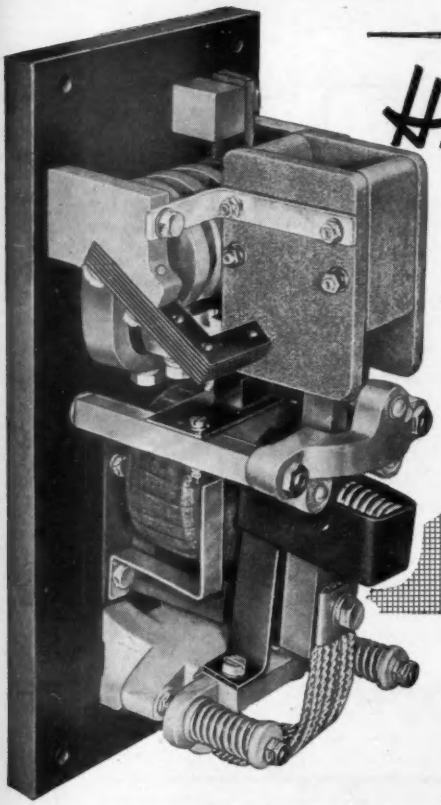

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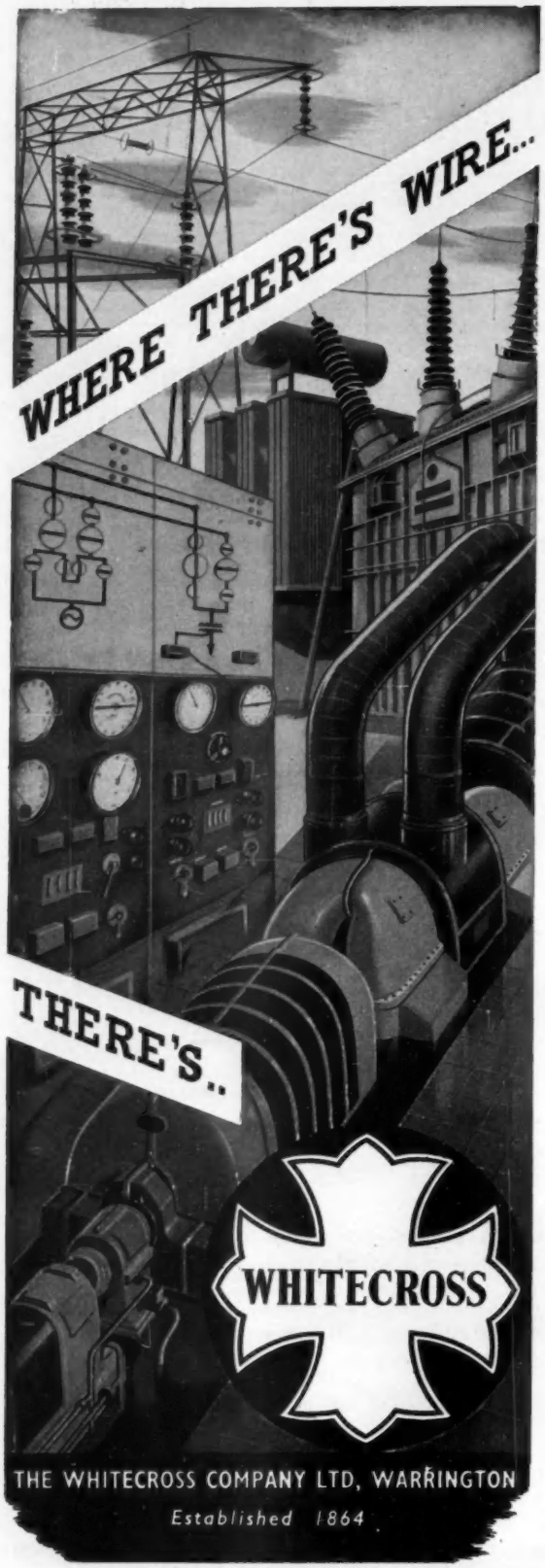

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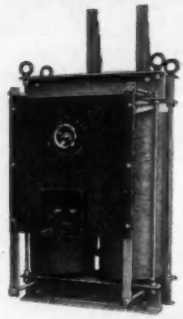

The illustration is of a 60 KVA Transformer with a 5,000 amp. Secondary, with tapped Primary to give secondary voltage variation from 12 volts to 4 volts. Primary tap changes are made with a rotary switch as shown. These Units are designed and tested to BSS 171 where applicable, or appropriate B.S. Specification.

This is a typical example of our "C" Core range. We manufacture both open and hermetically sealed types, wound to customers' specifications. This range extends from 10 VA to 1.6 KVA at frequencies up to 2,000 cps.

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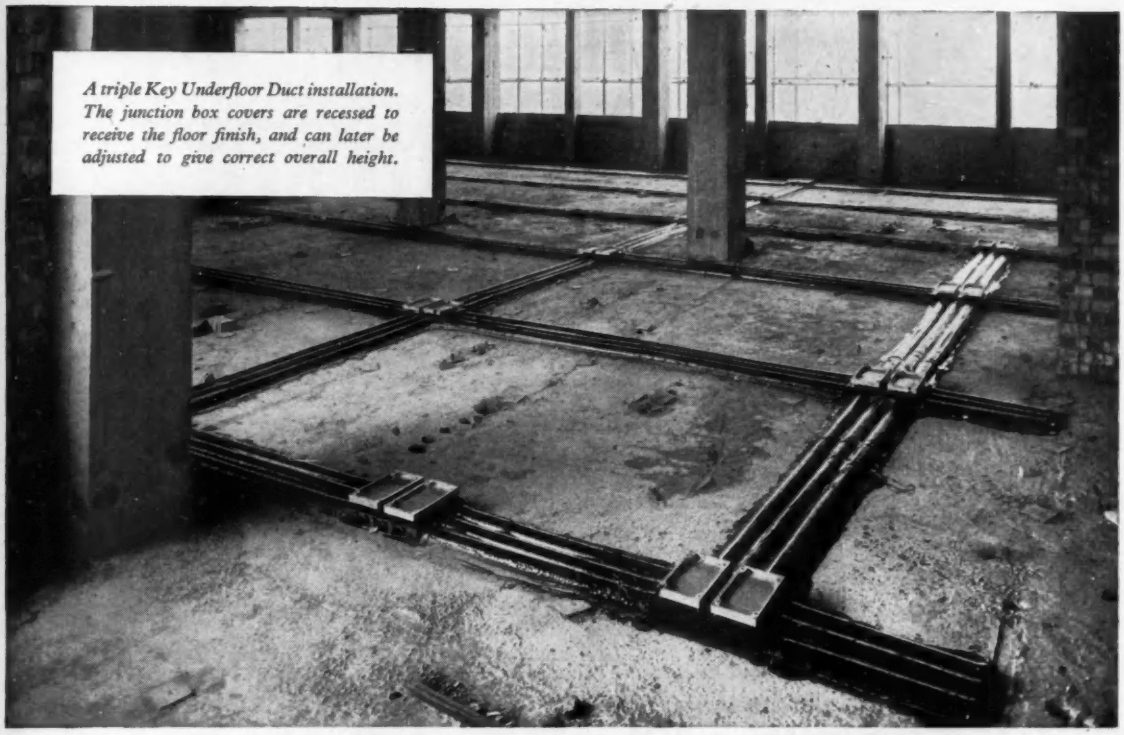
Key Underfloor Duct
solves wiring problems economically



A triple Key Underfloor Duct installation. The junction box covers are recessed to receive the floor finish, and can later be adjusted to give correct overall height.

Electric power and telephone outlets can be installed and added as necessary when Key Fibre Underfloor Duct is used. On a materials plus labour basis the cost of installations is lower than any metal system. Because of their light weight and ease of cutting and fitting, Key ducts can be quickly laid. Since there is no necessity to pre-position outlets, the architect can install an underfloor duct scheme, and later fit outlets to suit the occupant's requirements. The fitting of these outlets is a quick and simple matter and the most complete range of fittings is available for lighting and telephone systems.

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conforms with B.S. 815 and is the original Underfloor Duct System. Key have the widest experience of Underfloor Duct Systems in the U.K.

Speed the job—cut the cost with the

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HOW TO SELECT THE BEST ELECTRICAL RESISTANCE ALLOY

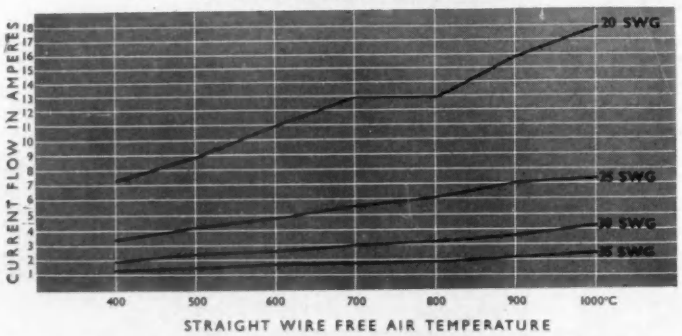
Fundamental considerations in the design of electrical heating equipment

ELEMENT TEMPERATURE—A VITAL DESIGN CONSIDERATION In designing electric heating equipment, element temperature is naturally a primary consideration for upon it depends the efficiency and reliability of the equipment. An element's life will be shortened if it is allowed to operate above the safe working limit of the material while operation below the maximum will result in a considerable extension of element life.

FACTORS GOVERNING ELEMENT TEMPERATURE Element temperature depends on two factors (1) the surface area electrical loading (usually expressed as watts per sq. in. of resistor surface area) and (2) local heat dissipating conditions. While the first can be determined accurately for any piece of equipment, the second is subject to many influences such as type of mounting, dimensions of spiral, circulation of air around the element. It cannot easily be determined exactly. The rate at which heat can be dissipated or removed from the element governs the surface area electrical loading that can be allowed. Thus certain types of water heaters and space heaters using a forced draught may be loaded to a high watts density, while an enclosed oven element may have a low watts density.

TESTING ELEMENT MATERIALS As a basis for determining desirable element temperatures, and hence suitable electrical loading, a wire of the material to be tested is held horizontally in free air and used as a datum during the test. The result of this test is known as the 'straight wire free air temperature'. Equivalent temperatures have been worked out to enable data based on this temperature to be related to many types of element.

BRIGHTRAY C WIRE



Graph showing Straight Wire Free Air Temperature/Current Flow for Brightray C

The choice of materials for electrical heating elements is a job for the expert. Our Technical Service engineers are always ready to give advice on the selection and application of Wiggin electrical resistance materials.

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BRIGHTRAY B *produced to provide a cheaper but satisfactory material for elements working up to 950°C . . .*

BRIGHTRAY S *for continuous heating up to 1150°C . . . principally intended for electric furnace heating elements . . .*

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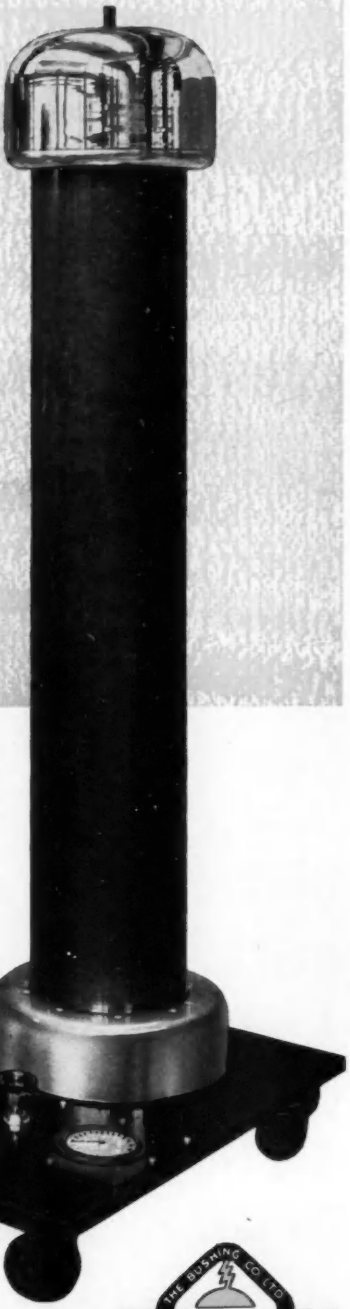
TCA 81A

STANDARD CAPACITORS



The Bushing Co. Ltd. manufactures a range of compressed gas capacitors intended for use as comparison standards for the measurement of capacitance and dielectric loss factor. The capacitors are constant in value and virtually loss-free.

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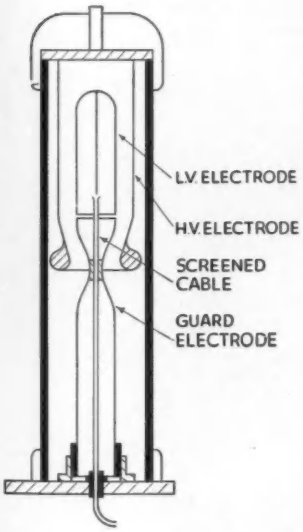

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And robes the mountain in its azure hue.

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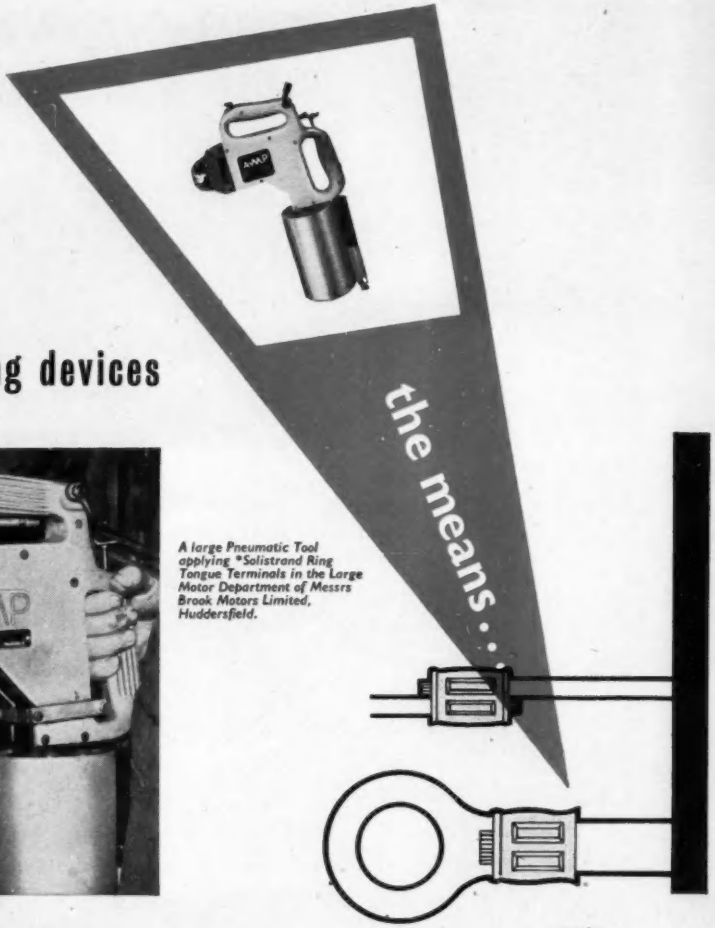
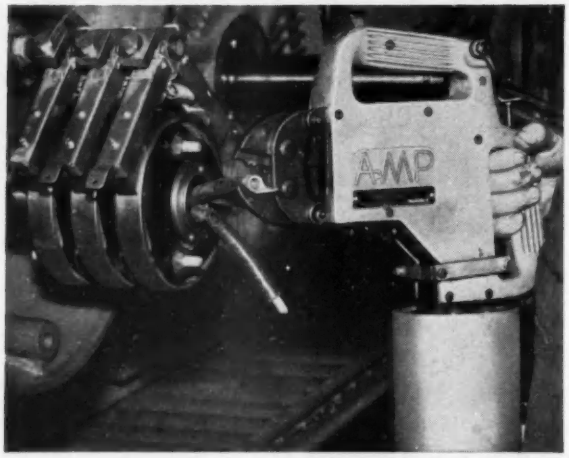
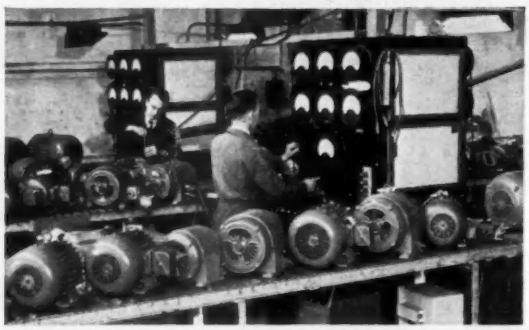




*A large Pneumatic Tool applying *Solistrand Ring Tongue Terminals in the Large Motor Department of Messrs Brook Motors Limited, Huddersfield.*



*Part of a Conveyor illustrating some of the Motors on which *A-MP Terminals are employed. With acknowledgments to Messrs. Brook Motors Limited*

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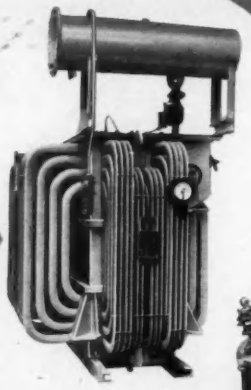

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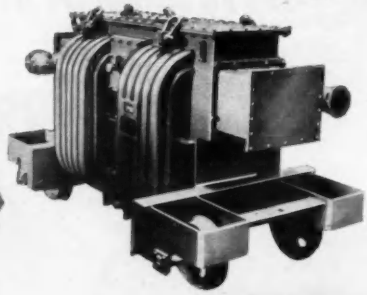

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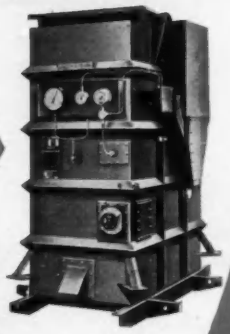

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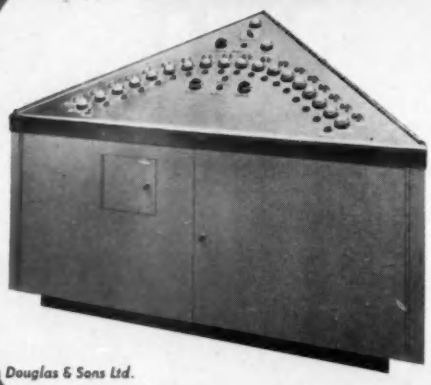

Illustration by courtesy of Messrs. William Douglas & Sons Ltd.

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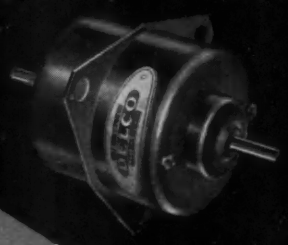
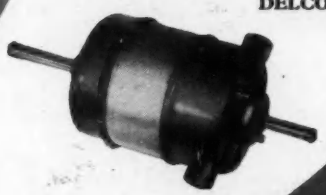


DELCO 310 Type



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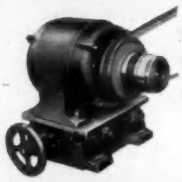

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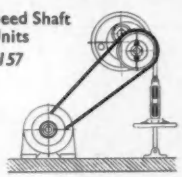

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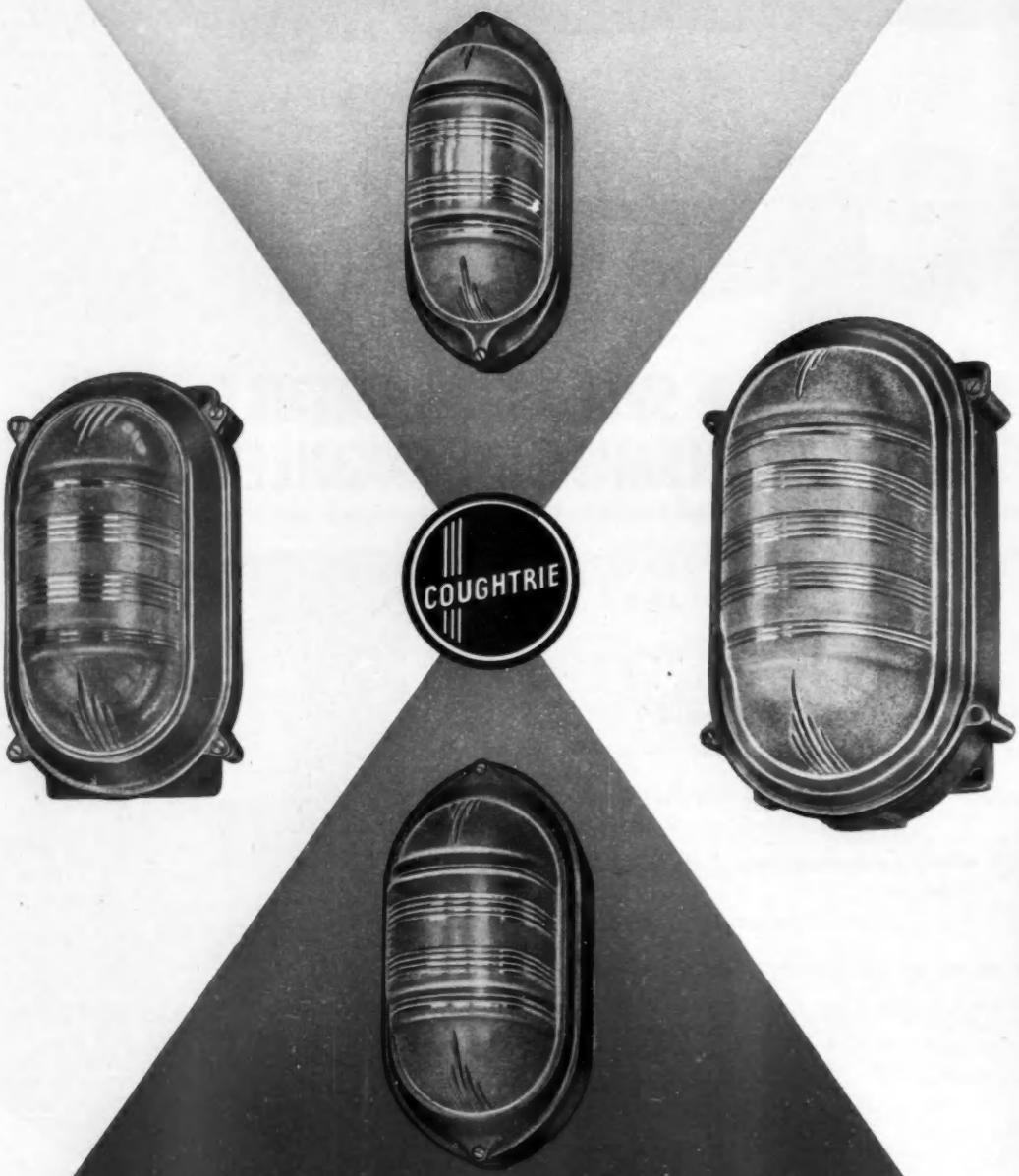

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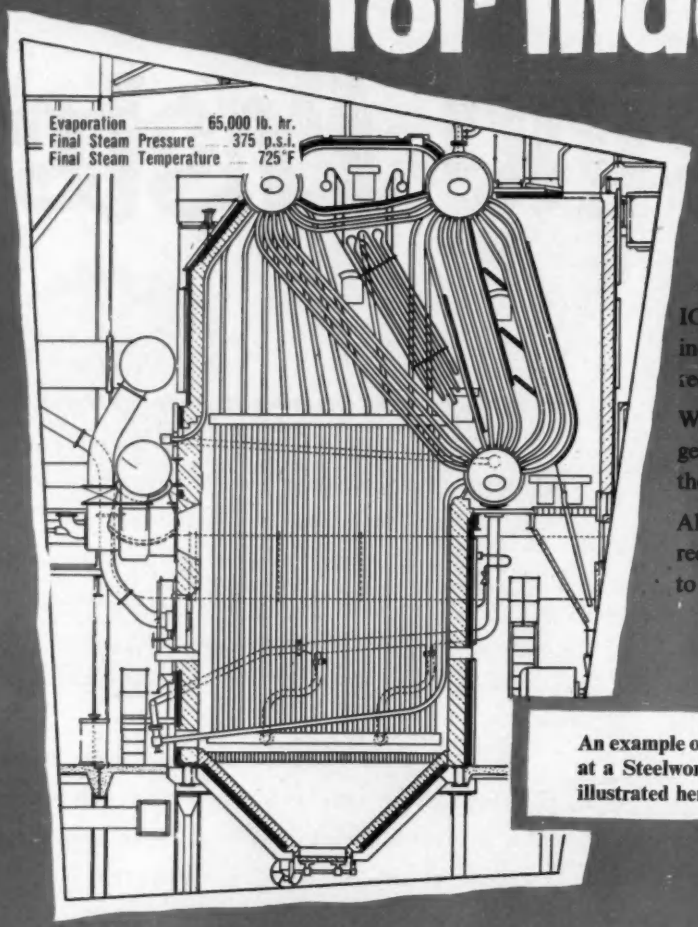

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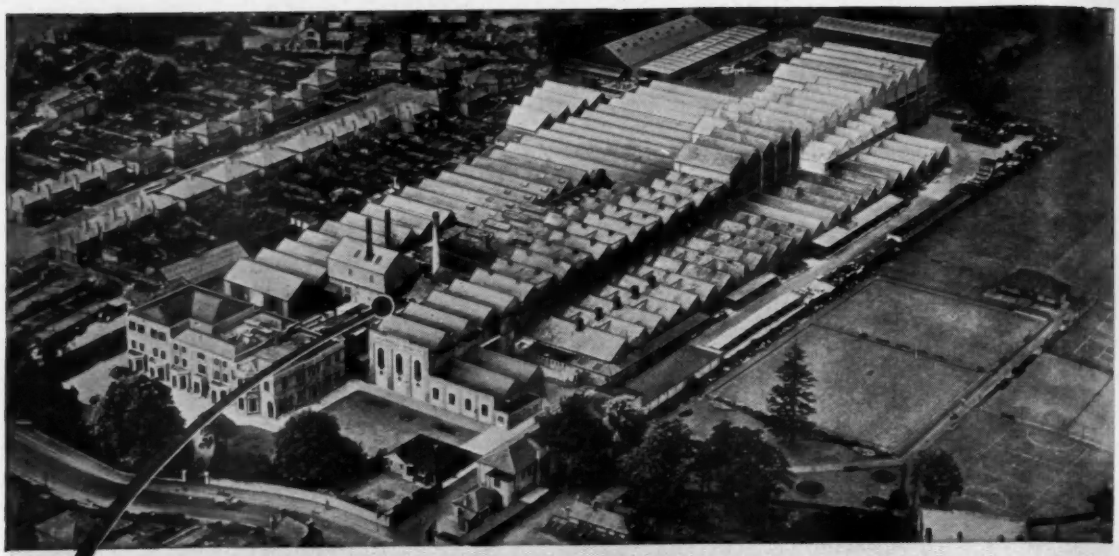

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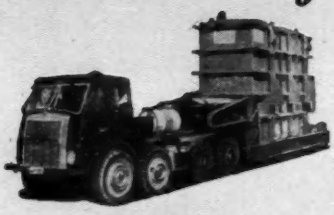

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Five 30 MVA 132/33 kV. 3-phase Hackbridge transformers for the Electricity Commission of New South Wales.

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Four 20 MVA 100/6.6 kV. 3-phase Hackbridge transformers for the Tata Hydro Electric Power Supply Co Ltd

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Three 5 MVA 33-22/6.6 kV. 3-phase Hackbridge transformers. Photo by courtesy of the China Light and Power Co. Ltd.

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Six 70 MVA 11/134 kV. 3-phase Hackbridge transformers for Skelton Grange Power Station, Leeds

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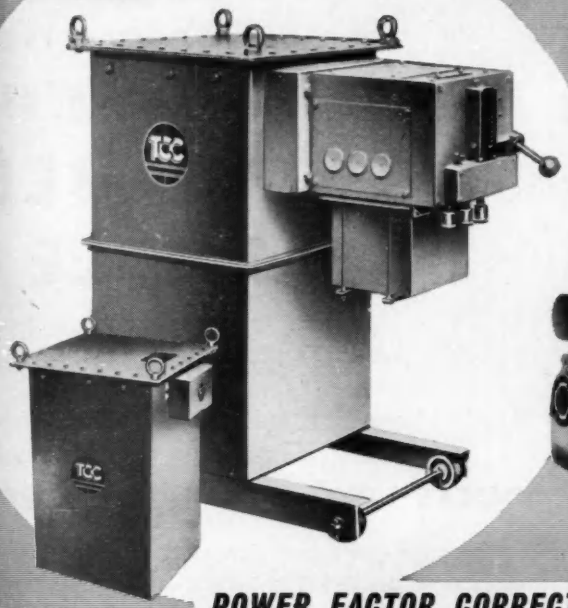

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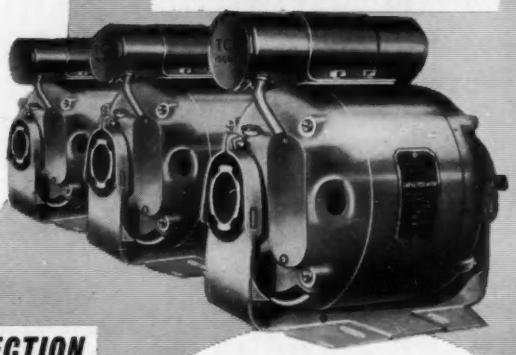

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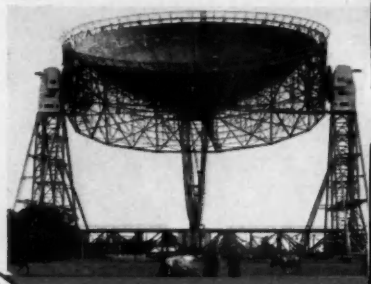

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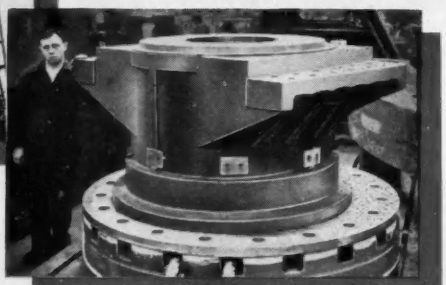

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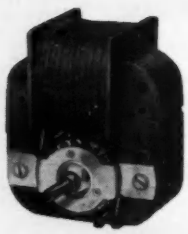

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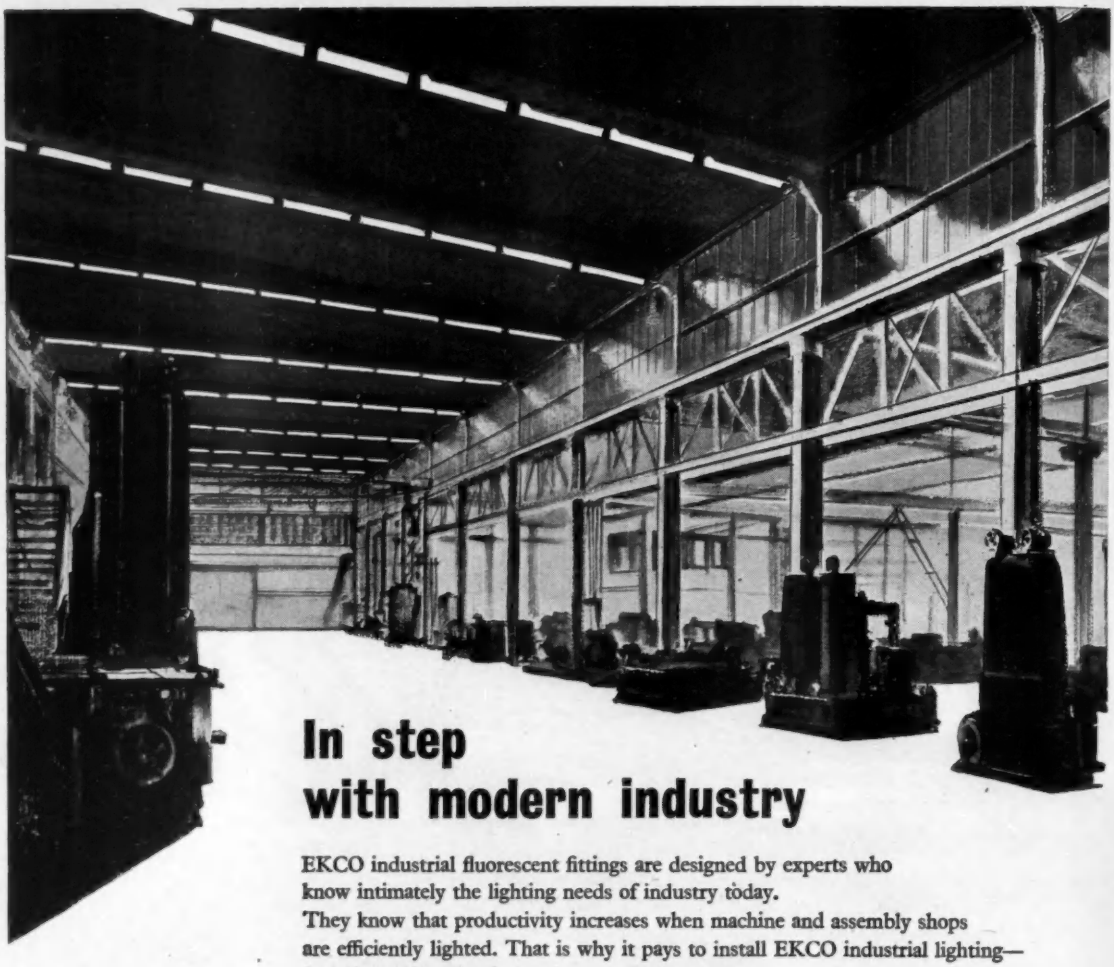

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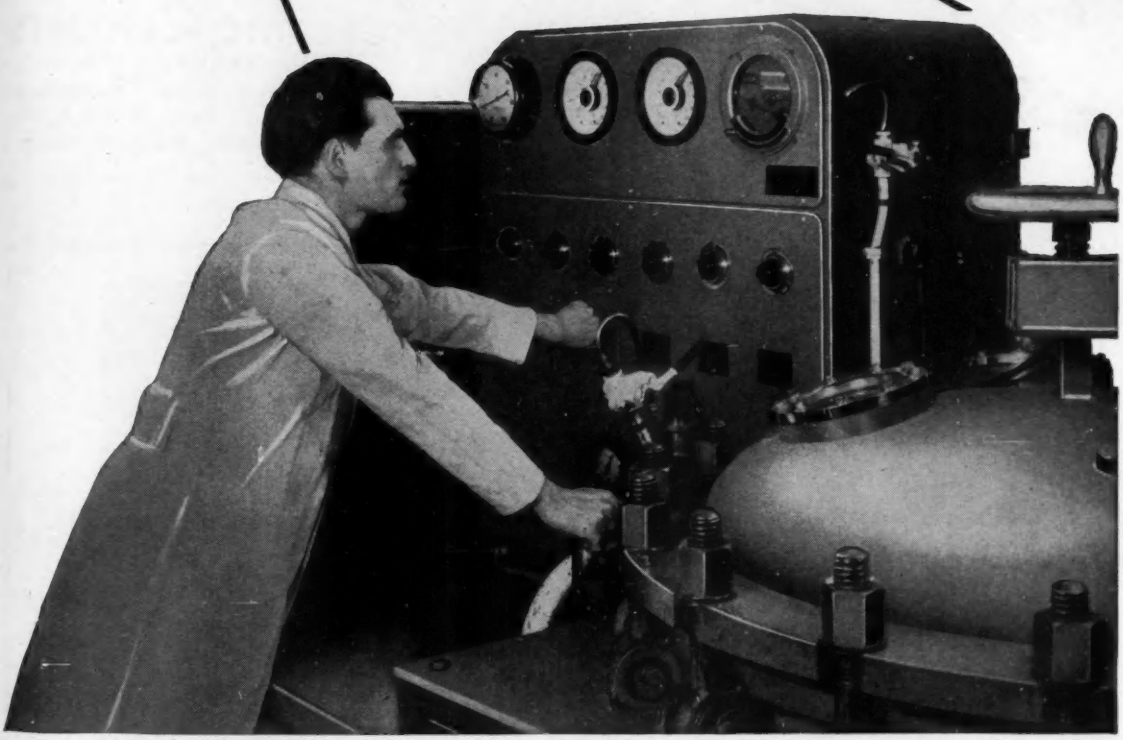

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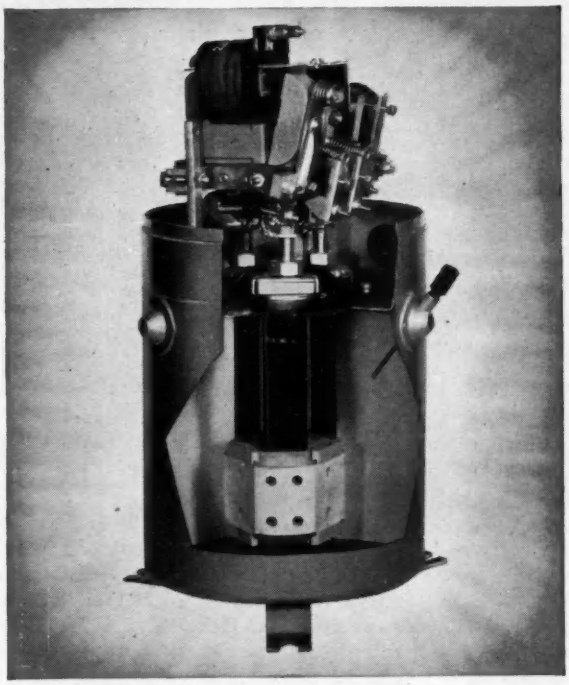

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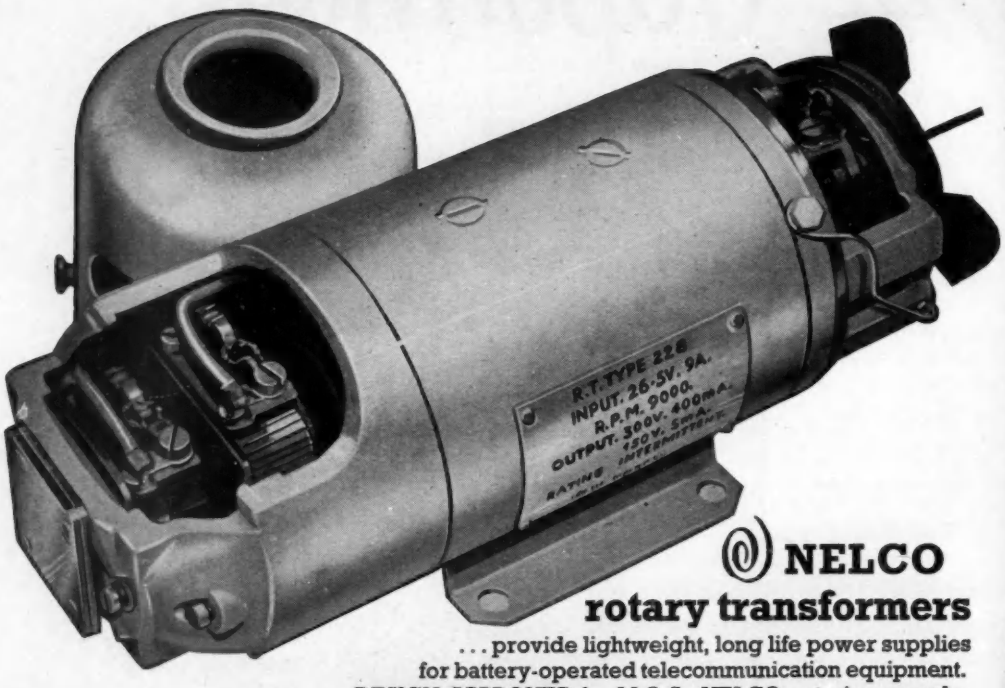

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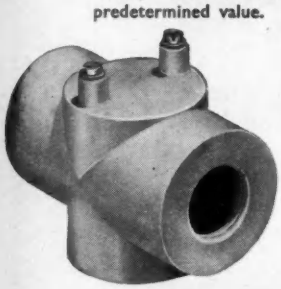

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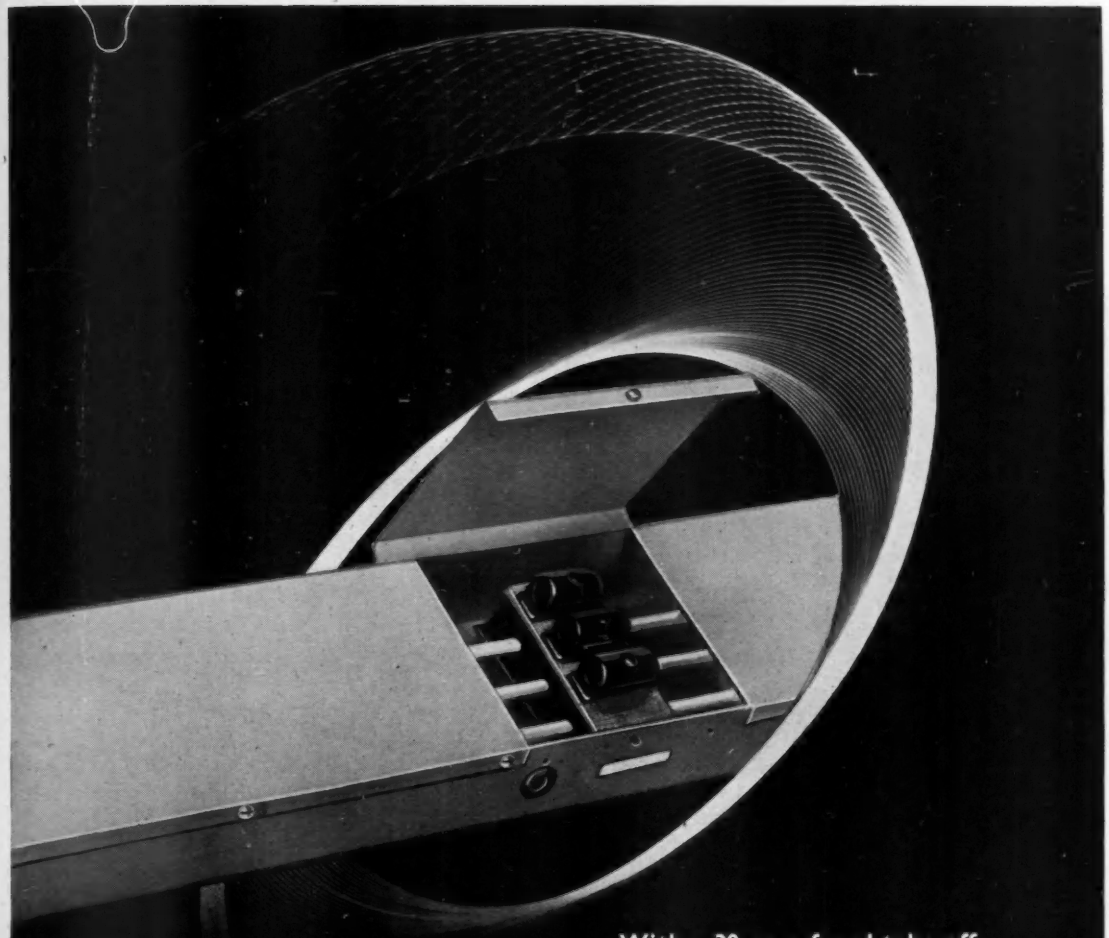

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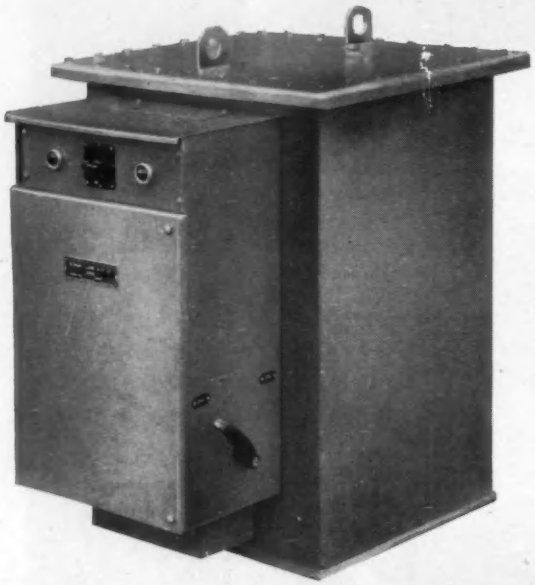

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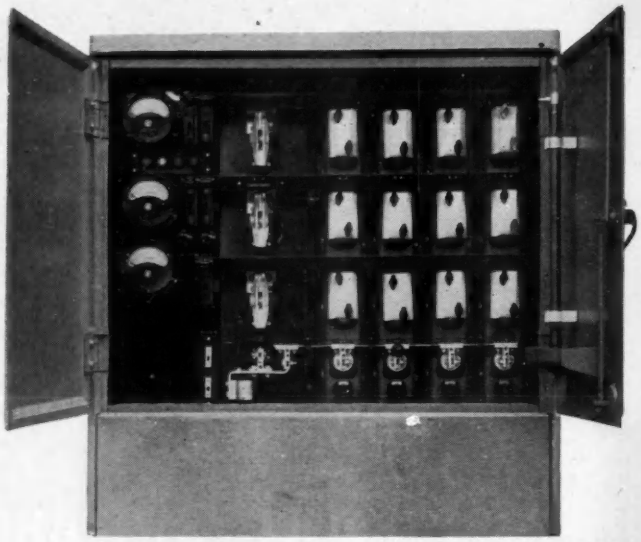

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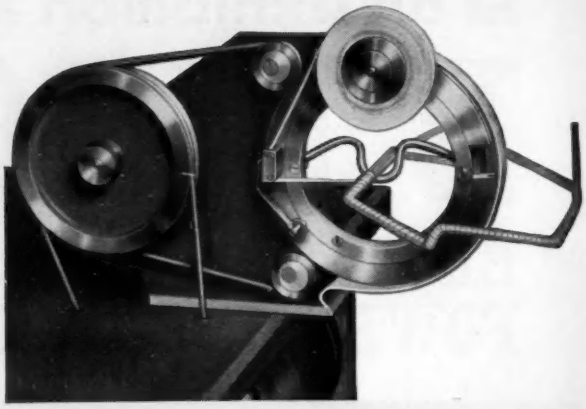

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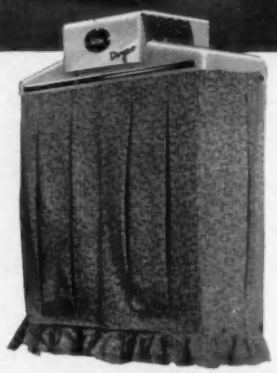

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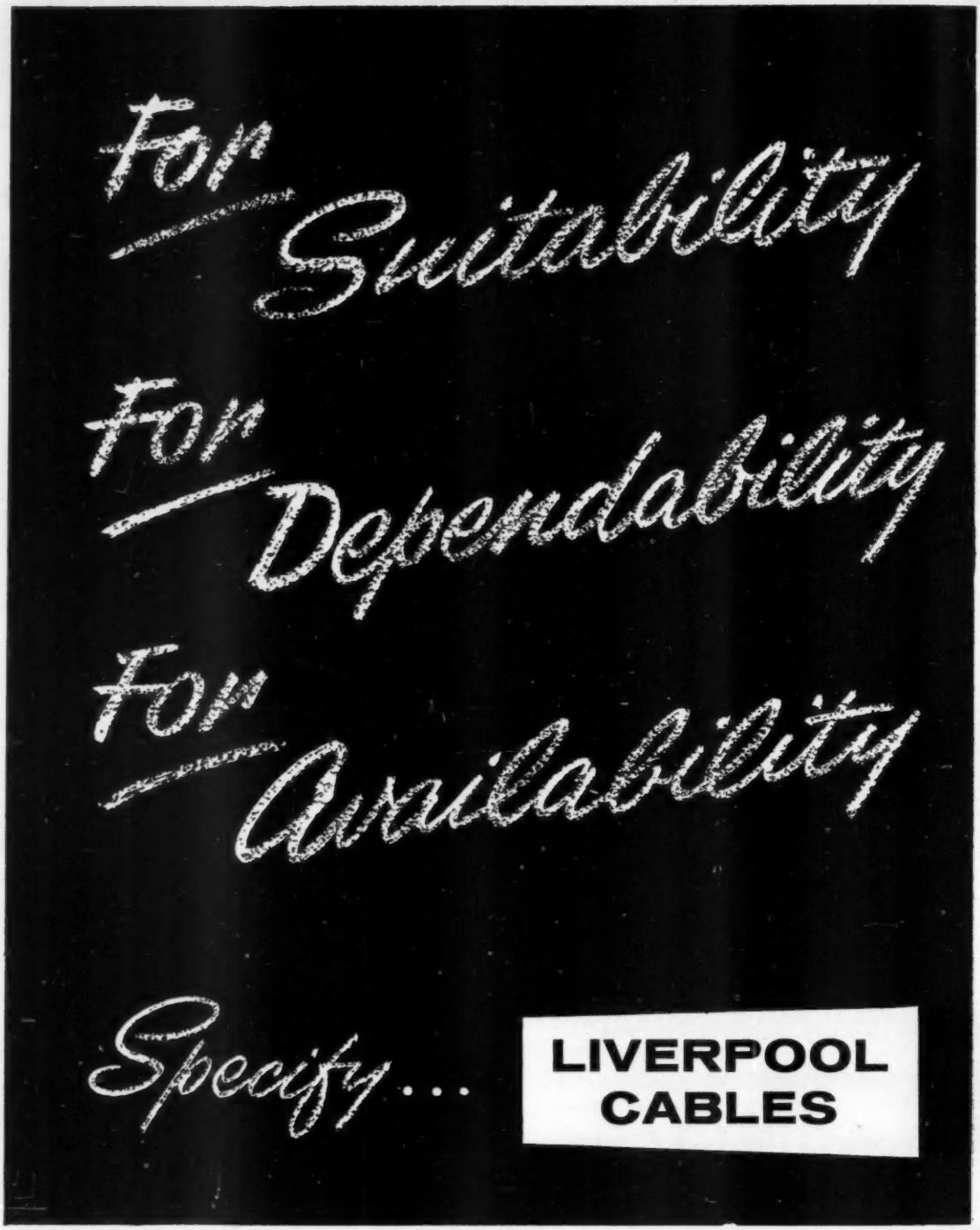

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Electrical Engineers and Contractors
24-30 Gillingham Street, S.W.1
Telephone: VICtoria 1713

One of the Largest Electrical Contractors in the Industry
ELECTRICAL INSTALLATIONS LTD.
65 Vincent Square, Westminster, S.W.1
Telephone: VICtoria 2266 (10 lines)

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
39 Victoria Street, S.W.1
Telephone: ABBey 8080 (8 lines)

TROUGHTON & YOUNG LTD.
2 Basil Street, London, S.W.3
Telephone: Kensington 3444
Electrical Engineers and Contractors

BURDETTE & CO. LTD.
150 Clapham Manor Street, S.W.4
Telephone: MACaulay 4555
Industrial Installations. Motor and Generator Repairs. Metallizing Treatments. Complete Electrical Maintenance. Heating and Ventilating.

WILSON ELECTRIC (BATTERSEA) LTD.
122a, Clapham Manor Street, S.W.4
Telephone: MAC 6768 & 3737
Electrical Engineers and Contractors. Motor Rewinds and Repairs. Installations. "Delco" Electric Motors—Approved Stockists and Repairers.

Industrial Installations throughout the Country. Power, Maintenance and Insurance
CITY ELECTRICAL CO.
Emerald Street, W.C.1 *Telephone: HOL. 9722 (6 lines)*
Repairs and Rewinds—Motor Stockists

A. TINDALL & SONS
22 Rosemary Avenue, Enfield
Electrical Engineers and Contractors
Telephone: ENfield 6612 (3 lines)

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SERVICE ELECTRIC CO. LTD.
Secomak Works, Honeypot Lane, Stanmore, Middx.
Telephone: EDGware 5566-7-8-9
Electrical Installations of every kind. Motor Rewinds. Factory Maintenance

DYNAMO & MOTOR REPAIRS LTD.
North End Road, Wembley Park
Telephone: Wembley 3121
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

SOUTH EASTERN

GALLIERS
32 St. James's Street, Brighton
Telephone: Brighton 23201-2-3
Farm and Dairy Electrical Equipment

Electrical, Refrigeration and Radio Engineers. Installation Contractors. Lifts. Television
H. BENEY & SONS LTD.
99 South Street, Eastbourne
Telephones 4820/1 (Day and Night)

For first-class A.C. and D.C. Rewinds and Industrial Plant Maintenance
ELECTRICAL POWER REPAIRS (Gillingham) LTD.
Strover Street, Gillingham, Kent
Telephone: Gill. 5200 & 59356 (Day and Night)

Heavy Engineering and Electrical Contracting
DRAKE & FLETCHER LTD.
Maidstone, Kent
Telephone 2284
Refrigeration. Oil Heating and Drying Installations

F. W. BLANSHARD LTD.
23 Lansdowne Road, Purley, Surrey
Telephone: Uplands 4818, 4819 & 4810
Complete electrical installations. Rewinding and repair of motors and transformers. Manufacturers of control gear for fluorescent.

SOUTHERN

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
32 Brassey Road, Winton, Bournemouth
Telephone: Winton 1609

. . . for all electrical installations
F. H. WHEELER (Southern) LTD.
Clifton Hall, Oakley Road, Shirley, Southampton
Telephone 73867

SOUTH WESTERN

. . . for all electrical installations
F. H. WHEELER (Bristol) LTD.
55 Queen Charlotte Street, Bristol 1
Telephone 26907

CLARKE BROS. (Stroud) LTD.
Bath Road, Stroud
Telephone: Stroud 1132/3
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

EASTERN

Norwich.....Cambridge.....Gt. Yarmouth.....Lowestoft.....Ipswich
EASTERN & HOME COUNTIES ELECTRICAL CONTRACTORS
Specialists in Large Scale Electrical Installation Contracts.
Westwood House, Southdown Road, Gt. Yarmouth
Telephone: Gt. Yarm. 2390

EAST MIDLANDS

Electrical Engineers and Contractors
C. A. J. BILLINGTON LTD.
Cranfield, Bedfordshire
Telephone: Cranfield 293
Industrial Installation throughout the Home Counties

MIDLANDS

WALKER BROS. (ELECTRICAL ENGINEERS) LTD.
Quality House, Temple Row, Birmingham 2
Telephone: CEN. 7611/5
Electrical Installation Engineers. Industrial Installation Specialists
Established 1895

(*Continued on page 188*)

(Continued from page 187)

HARRIS & SHELDON LTD.
31 Stafford Street, Birmingham 4
Telephone: Central 7101
For all electrical contracting installations, lighting, heating, power, public address, etc.

Electrical and Mechanical Engineers, Factors
THE BIRMINGHAM POWER TRANSMISSIONS LTD.
56-62 Miller Street, Aston, Birmingham 6
Telephone: AST. 2088-9

For Electrical Installations of Quality consult:
HAROLD F. WARD LIMITED
Birmingham 11
Telephone: VIC. 4041 (5 lines)

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
553 Moseley Road, Birmingham 12
Telephone: Calthorpe 2601-2

DYNAMO & MOTOR REPAIRS LTD.
Belgrave Terrace, Soho Road, Birmingham 21
Telephone: Northern 0898
Motor and generator repairs and rewinds. Installations and factory maintenance. Electrical plant stockists

ELECTRICAL INSTALLATIONS LTD.
Faraday Works, Stoney Stanton Road, Coventry
Telephone 2970
Industrial Electrical Work of All Kinds. Over 40 Years' Experience

G. G. WALKER & CO. (Dudley) LTD.
31 Hall Street, Dudley
Telephone 4474/5
Rewinds, Lighting, Power, Electric Furnace, Electronic Installations and Maintenance, Television and Radio. Est. 40 years. E.C.A. Members

THE TRUMAN ELECTRICAL COMPANY
40-42a, Upper Bridge Street, Walsall, Staffs
Telephone 2198 (3 lines)
Electrical Installations, Heating and Ventilating

SOUTH WALES

CLARKE BROS. (Stroud) LTD.
Green Park Street, Aberavon
Telephone: Port Talbot 791
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

DRAKE & GORHAM (Contractors) LTD.
13 St. Andrew's Crescent, Cardiff
Telephone: Cardiff 32080
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
117 Woodville Road, Cardiff
Telephone 21281-2 *Telegrams: "Whelect"*

CLARKE BROS. (Stroud) LTD.
High Street, Merthyr Tydfil
Telephone: Merthyr Tydfil 377
Electrical Engineers and Contractors
Rewinds and Repairs. Industrial Installations

MERSEYSIDE & N. WALES

TROUGHTON & YOUNG LTD.
46 Rodney Street, Liverpool 1
Telephone: Royal 9231-2
Electrical Engineers and Contractors

H. J. CASH & CO. LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

YORKSHIRE

Electrical Engineers and Contractors
SOUTHERN & REDFERN LTD.
Woodhead Road, Bradford 7
Textile Maintenance, Repairs and Rewinds
Telephones: Bradford 23871—Late Phone: Bradford 65837

DALE ELECTRIC (YORKSHIRE) LTD.
Filey, Yorks. Also at Malton and Driffield
Telephone: Filey 2301 (3 lines)
Electrical Contractors and Manufacturers
Estimates given for all types of electrical installations without obligation

EDMUNDSONS CONSTRUCTION CO. LTD.
Electrical Engineers and Contractors
2 Hartley Hill, Leeds 2
Telephone: Leeds 33791

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
44 Bank Street, Sheffield 1
Telephone 24015 (3 lines) *Telegrams: "Whelect"*

NORTH WESTERN

H. J. CASH & CO LTD.
28 Chapel Street, Liverpool 3
Telephone: Central 0452
Electrical Engineers and Contractors

STEWART THOMSON & SONS (Liverpool) LTD.
Fort Road, Seaforth, Liverpool 21
Repairs and Rewinds A.C. and D.C. to 3,000 horsepower. Breakdowns, Urgent Repairs, etc. 24-hour service
Telephone: Bootle 2697-8

DRAKE & GORHAM (Contractors) LTD.
21 Newton Street, Piccadiliy, Manchester 1
Telephone: Manchester Central 4701
Electrical Engineers and Contractors

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
Regal Buildings, Oxford Road, Manchester 1
Telephone: Central 8207-8

Industrial Installations
W. H. SMITH & CO. ELECTRICAL ENGINEERS LTD.
12 York Street, Manchester 2
Telephone: CENtral 2991-6
Works: Praed Road, Trafford Park, Manchester 17

THE NELSON ENGINEERING CO. LTD.
Telephone: Nelson 1545/6
Electrical and Mechanical Engineers.
Complete Industrial Installations. Rewinds
Netherfield Road, Nelson

NORTH EASTERN

DALE ELECTRIC (YORKSHIRE) LTD.
Filey, Yorks. Also at Malton and Driffield
Telephone: Filey 2301 (3 lines)
Electrical Contractors and Manufacturers
Estimates given for all types of electrical installations without obligation

. . . for all electrical installations
F. H. WHEELER & CO. LTD.
52 Elswick Road, Newcastle
Telephone: Newcastle 36271

Applications for particulars of costs and standard style of advertisements in this Regional Guide should be addressed to :

THE
ADVERTISEMENT DEPARTMENT,
ELECTRICAL REVIEW,
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1

Yours for the asking!

THE NEW
BKS
CATALOGUE
Copy sent FREE on application to

Gives FULL INFORMATION and PRICES for current Range of
ELECTRICAL CONTROL EQUIPMENT

British Klockner Switchgear Limited
CHERTSEY, SURREY *Tel.: Chertsey 2067*

CUTS THE COST OF TRUNKING

It is with considerable pleasure that we announce the opening of a completely new factory, designed, planned and equipped on the most modern lines.

We are confident that with the up-to-date plant and methods employed the factory will function as a most efficient production unit and, as a contribution to the national economy we have decided immediately to reduce the prices of our Surface Pattern Cable Trunking.

A revised price list PRI/58, which will apply to all orders dated 9th June, 1958 and onwards, has been sent to all our known customers. If you have not received a copy please advise us.

Our Head Office is still being maintained at the address below and we trust that the reduced prices will enable you to increase your volume of business with us.

THE POWER CENTRE CO LTD

LLOYD STREET · WEDNESBURY · STAFFS

'Phone: WEDnesbury 1311
'Grams: "Powcent, Wednesbury"
LONDON OFFICE: Wharf Estate, Ealing Road, Alperton, Middlesex. Tel.: Wembley 8866.

A GKN Company

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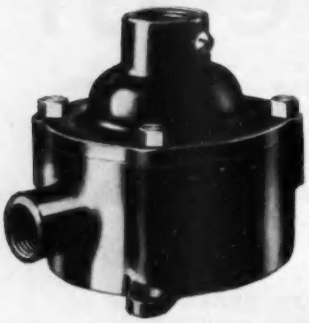
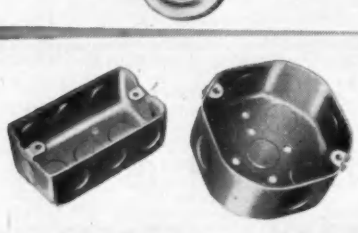
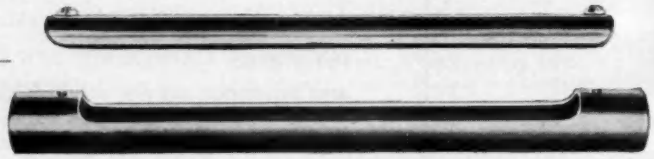




Conduit fittings for every type of installation



Ensure a reliable electrical installation by always using G.E.C. Conduit Fittings.

These comply where applicable with B.S.31, B.S.229, Ministry of Fuel and Power and appropriate American and Canadian standards.

Specify

CONDUIT FITTINGS

by G.E.C.

THE GENERAL ELECTRIC COMPANY LTD.

Magnet House, Kingsway, London, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to First Post on Monday of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

AUCKLAND'S GOLDEN JUBILEE ELECTRICAL EXHIBITION

Auckland, New Zealand: Easter, 1959

THE AUCKLAND ELECTRIC-POWER BOARD is staging an Electrical Exhibition to be held in conjunction with the Manufacturers' Easter Show, at the Epsom Showgrounds, Auckland, for three weeks extending over the Easter period of 1959. (Attendance 1958, 245,509.)

An Historical Court, sponsored by the British Electrical and Allied Manufacturers' Association, will depict the development of electrical science and equipment over the years.

A special building, together with space under canvas and outdoor areas for heavier equipment, will be available for the display of all types of modern electrical machinery and appliances, including electronic and medico-electrical equipment.

Applications for exhibition space are to be addressed to the Auckland Electric-Power Board and will close at Auckland on 31st July, 1958. Application forms and further details can be obtained from Preece, Cardew & Rider, Consulting Engineers, 8-12, Queen Anne's Gate, London, S.W.1.

3799

COUNTY BOROUGH OF GATESHEAD

Alterations and Extensions to the Boys' Grammar School at Shipcote

APPLICATIONS are now invited from contractors desirous of tendering for the

ELECTRICAL WORKS

at the above, in accordance with the scheme and specification prepared by Messrs. R. W. Gregory & Partners.

Intending contractors should give evidence of having recently carried out contracts of similar size. The contract for this work will form a sub-contract to the Main Building Contract, and the Sub-Contractor will be required to enter into a bond with the General Contractor.

The contract will not include any clause to cover adjustments for fluctuations in contractors' costs.

Applications to tender should be made in writing not later than Wednesday, 18th June, 1958, to the Borough Surveyor, Municipal Buildings, Swinburne Street, Gateshead, 8, with a deposit of £2 2s., which will be refunded on receipt of a bona fide tender and the return of the drawings and specification.

The Council do not bind themselves to accept the lowest or any tender.

C. D. JACKSON,
Town Clerk.

Town Hall,
Gateshead, 8.
2nd June, 1958. 3768

DURHAM COUNTY COUNCIL

TENDERS invited:—

Hurworth-on-Tees New Modern School—Electrical Installation.

Application for further details to the County Architect, South Street, Durham, not later than 25th June, 1958.

J. K. HOPE,
Clerk of the County Council.

Shire Hall, Durham. 3786

STAFFORDSHIRE COUNTY COUNCIL EDUCATION COMMITTEE

County Technical College, Stafford

TENDERS are invited for the supply of:—

1 Ionisation Pressure Gauge.
2 Cathode Ray Oscillographs.
1 6-Anode Mercury Arc Rectifier.

Forms of tender and details of requirements may be obtained from the Principal of the College, Tenterbanks, Stafford.

Completed tenders in a plain sealed envelope bearing no mark of the tenderer but endorsed "Tender for Electrical Equipment" should reach the undersigned by noon on Saturday, 28th June, 1958.

T. H. EVANS,
Clerk to the County Council.

3769

COUNTY BOROUGH OF READING

To Electrical Contractors

FIRM price tenders are invited for the alteration and re-wiring of the existing system at Kendrick Girls' School and West Wing, Reading School. General conditions may be inspected and the specifications, drawings and forms of tender can be obtained from the Borough Architect, Town Hall, Reading.

Tenders to reach the Town Clerk, Town Hall, Reading, by noon, Friday, 4th July, 1958.

No tender considered unless enclosed in the endorsed envelope provided, which shall bear no indication of the sender.

The Corporation do not bind themselves to accept the lowest or any tender. 3751

SITUATIONS VACANT

JOHNSON & JOHNSON (GT. BRITAIN) LTD.

Permacel Tapes Division

APPLICATIONS invited from men of personality and ability for the important appointment of TECHNICAL SALES ADVISER. Applicants should have a basic knowledge of electrical engineering with an accepted qualification as well as a thorough experience in selling. They should be aged between 30 and 45 years.

The successful candidate must be prepared to travel anywhere in the United Kingdom, as he will be required to call on works directors and arrange tests in factories in all parts of the country.

This is an interesting post for an ambitious man. It carries a high salary and generous expenses, and a car will be provided.

Please send applications in confidence to Mr. W. Linton Thomson, Permacel Tapes Division, Johnson & Johnson (Gt. Britain) Ltd., Slough, Bucks. 3800

TRANSFORMER DRAUGHTSMEN

SENIOR and JUNIOR DRAUGHTSMEN with experience on power transformers in range 5 to 10,000 kVA required. Permanent positions offering good salary according to experience. Pension, life assurance scheme, etc. Evening and Saturday interviews can be arranged. Write stating age, experience and qualifications to:—

Chief Engineer
BRYCE ELECTRIC CONSTRUCTION CO. LTD.,
Kelvin Works, Hackbridge, Wallington, Surrey. 3650

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

SHIFT CHARGE ENGINEERS,
HIGH MARNHAM POWER STATION
(Vacancy No. 88/58/ER).

Applications are invited for the appointment of Shift Charge Engineers at High Marnham Power Station, which is now under construction. The ultimate capacity of this station will be 1,000 MW.

This power station is situated in a rural area on the River Trent, approximately fourteen miles south of Gainsborough and five miles east of Tuxford in the county of Nottinghamshire.

Candidates should have had a sound technical training and considerable experience in a large modern power station. Preference will be given to candidates who possess qualifications admitting to Corporate Membership of the Institution of Electrical and/or Mechanical Engineers, and a knowledge of pulverised fuel firing will be an advantage.

The salary will be in accordance with Class L, Grade 7 (£1,235-£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 18th June, 1958.

ELECTRICAL MAINTENANCE ENGINEER,
LEICESTER POWER STATION
(Vacancy No. 89/58/ER).

Applicants should have had a good general education and technical training. A wide experience in the maintenance of E.H.T. switchgear and power station electrical auxiliaries is essential.

Qualifications entitling to Graduate Membership of the Institution of Electrical Engineers would be an advantage.

The salary will be in accordance with Class G, Grade 6 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 18th June, 1958.

GENERAL ASSISTANT ENGINEER,
DRAKELOW POWER STATION
(Vacancy No. 91/58/ER).

Applicants should be suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £540-£680 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 25th June, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

4th June, 1958. 3772

Situations Vacant (continued)

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

SUB-AREA COMMERCIAL OFFICER. Applicants must have wide commercial experience in the electricity supply industry. The person appointed will be responsible to the Sub-Area Manager for all commercial activities within the Sub-Area organisation.

Salary N.J.M. Class C, Grade 5, £1,900/£2,100 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Market Street, Huddersfield, not later than 27th June, 1958.

No. 4 (Leeds) Sub-Area

SECOND ASSISTANT ENGINEER (Distribution Design). Applicants should have experience in the design, construction and operation of H.V. and L.V. systems and possess qualifications equivalent to the Higher National Certificate. Corporate membership of the Institution of Electrical Engineers is preferable. Experience in dealing with consumers on engineering aspects of industrial and commercial supplies will be an advantage.

Salary N.J.B. Class L, Grade 7, £1,235/£30/£1,325 per annum.

LEEDS DISTRICT.

FOURTH ASSISTANT DISTRICT ENGINEER. Applicants should be Graduate Members of the Institution of Electrical Engineers and have experience in the construction, operation and maintenance of overhead and underground networks and substations in a densely populated urban district.

Salary N.J.B. Class K, Grade 11, £885/£15/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Bramhope, near Leeds, not later than 27th June, 1958.

Head Office

CHIEF ENGINEER'S DEPT.

THIRD ASSISTANT ENGINEER, Distribution Design (Mains) Section. Applicants should have had experience in the design and installation of underground cables systems up to and including 33 kV. Some knowledge of oil-filled and gas-pressure installations up to 66 kV, of cable manufacture and of overhead line construction will be an advantage. Applicants should preferably be Corporate or Graduate Members of the Institution of Electrical Engineers.

Salary N.J.B. Class AX-EX, Grade 6, £895/£85/£1,020 rising to £1,140 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, near Leeds, not later than 27th June, 1958.

No. 6 (Hull) Sub-Area

GOOLE DISTRICT.

SECOND ASSISTANT DISTRICT ENGINEER. Applicants should have had sound practical experience in the operation, maintenance, planning and construction of H.V. and L.V. underground and overhead lines and substations in an extensive rural area. Preference will be given to candidates who have the Higher National Certificate in Electrical Engineering or possess equivalent qualifications. The successful candidate will be required to undertake standby duty and to reside in Goole or near vicinity.

Salary N.J.B. Class E, Grade 7, £835/£15/£880 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 27th June, 1958. 3803

W. S. ATKINS & PARTNERS

have a vacancy for an ELECTRICAL ENGINEER with experience of industrial installations from design to site supervision. Candidates should be a graduate of the I.E.E. or have an H.N.C. Applications in writing with full particulars to Personnel Manager, 158, Victoria Street, London, S.W.1. 3762

A. REYROLLE & COMPANY LTD., HEBBURN

have a vacancy in their RESEARCH DEPARTMENT for a

UNIVERSITY GRADUATE, preferably with Honours Degree in Electrical Engineering or Physics, to undertake research into problems relating to oil, air-blast and air-break switchgear.

Reyrolle are among the largest manufacturers of switchgear in the world; they are a member firm of the Nuclear Power Plant Company, and their work covers a wide field. The appointment advertised is in accordance with staff conditions and offers interesting work with good prospects, at a salary commensurate with qualifications and experience. Assistance may be given with housing.

Write in confidence with full particulars to the Chief Engineer, A. Reyrolle & Company Ltd., Hebburn, Co. Durham. 3809

GOVERNMENT OF QATAR (PERSIAN GULF)

Power Station Superintendent

APPLICATIONS are invited for the appointment of POWER STATION SUPERINTENDENT to take charge of the Qatar State Electricity Department's main generating station, which at present contains four 2,600-kW diesel alternator sets with ancillary equipment and 11-kV switchgear, and to supervise the Department's other subsidiary smaller diesel stations.

Candidates must have had considerable experience of the operation and maintenance of diesel engines of up to 4,000 b.h.p., preferably in a position of similar responsibility, and must have sufficient electrical knowledge to handle the main station control board and 11-kV switchgear.

They must hold an appropriate professional qualification such as Corporate Membership of the Institution of Mechanical Engineers or the Institution of Electrical Engineers, or M.O.T. 1st Class Certificate (Diesel), or other similar qualification.

TERMS AND CONDITIONS OF SERVICE

Probationary period of six months during which the contract may be terminated at three months' notice by the Government. Contract for five years subject to successful completion of probationary period. The employee may terminate the contract by giving three months' notice in writing after completing one year's service.

The salary scale is from Rs. 2,500 per month rising by annual increments of Rs. 100 to a maximum of Rs. 3,200 per month. The point of entry into the scale will be in accordance with the candidate's qualifications and experience. A gratuity amounting to one month's salary for each completed year of service is payable on completion of contract only.

Free furnished bachelor accommodation, fuel, light and water. Married accommodation will be provided if desired as soon as it becomes available provided, however, that the Government retains the right to recover the cost of any passages for wife and family if the appointment is terminated within the probationary period.

Leave is earned at the rate of six days per completed month of duty and may be taken annually. Free air or sea passages on first appointment, on leave and on final termination of contract are provided for applicant, wife and children up to 18 years of age.

Medical and dental treatment for the employee and his family are provided free. A knowledge of Arabic would be an advantage, and in any case the employee will be expected to apply himself to a diligent study of colloquial Arabic and to reach the standard of efficiency required by the Government regulations. All calculations of pay and leave according to the Arabic calendar in force in Qatar.

Applications endorsed "Power Station Superintendent, Qatar," accompanied by full personal particulars, including age, education, qualifications, experience, religion and past employment, should be made in writing within 14 days of the date of this advertisement to Preece, Cardew & Rider, 8, 10 & 12, Queen Anne's Gate, Westminster, London, S.W.1.

3760

SOUTH WESTERN ELECTRICITY BOARD

HEAD OFFICE, BRISTOL

ESTABLISHMENTS OFFICER

Provisional salary within Grade A.7, £1,900-£2,100 per annum, subject to confirmation by the National Joint Managerial and Higher Executive Grades Committee.

The person appointed will be responsible to the deputy secretary for the whole field of personnel work, including industrial relations, negotiations, health and welfare, education and training, determination of establishment and gradings, together with supervision of house services in Electricity House, Bristol.

Applicants should have an extensive knowledge of the supply industry, and establishment and personnel work, and should be capable of advising on the formulation of the Board's personnel policy.

Applications to be made on standard application form A.E.6/ACT obtainable from Deputy Secretary, South Western Electricity Board, Electricity House, Bristol, 1. Closing date for receipt of completed applications is 28th June, 1958. Requests for application forms to be made by postcard only.

PLYMOUTH DISTRICT

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER, PLYMOUTH.

Salary according to Class G, Grade 8, £885 × £15 to £930 per annum of the N.J.B. Agreement.

The successful candidate will be responsible to the first assistant district commercial engineer for the supervision of all classes of work associated with a large contracting unit. He will also be expected to deal with the preparation of estimates and specifications.

Experience of workshop control would be an advantage. Technical qualifications at least equivalent to the Higher National Certificate in Electrical Engineering are desirable. The possession of a current driving licence will be an advantage.

Applications to be made on standard application form A.E.6/ACT obtainable from District Manager, South Western Electricity Board, Armada Street, Plymouth. Closing date for receipt of completed applications is 28th June, 1958. Requests for application forms to be made by postcard only.

WEST CORNWALL DISTRICT

FOURTH ASSISTANT DISTRICT ENGINEER, WEST CORNWALL (Camborne).

Salary according to Class F, Grade 11, £685 × £15 to £730 per annum of the N.J.B. Agreement.

The successful candidate will be required to assist generally in operation and maintenance work on 11-kV and 33-kV systems within the district.

The possession of the Higher National Certificate in Electrical Engineering is desirable and a current driving licence would be an advantage.

Applications to be made on standard application form A.E.6/ACT obtainable from District Manager, South Western Electricity Board, 13, Basset Road, Camborne, Cornwall. Closing date for receipt of completed applications is 28th June, 1958. Requests for application forms to be made by postcard only. 3812

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

Tyne Sub-Area

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER, with location at Ryton District. Applicants should possess H.N.C. in Electrical Engineering. Salary Schedule A, Class F, Grade 10, £740/£785. N.J.B. conditions of service.

Tees Sub-Area

THIRD ASSISTANT DISTRICT ENGINEERS, with location at Darlington District and Hartlepools District, respectively. Salary Schedule A, Class F, Grade 9, £790/£835. N.J.B. conditions of service.

Applications stating age, qualifications and experience, to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 3815

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

STATION SHIFT CONTROL ENGINEER, STAYTHORPE POWER STATION (Vacancy No. 93/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate or its equivalent would be advantageous.

The salary will be in accordance with Class K, Grade 10 (£935 - £995 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 25th June, 1958.

GENERAL ASSISTANT ENGINEERS, WILLINGTON, STAYTHORPE AND OTHER LARGE POWER STATIONS (Vacancy No. 92/58/ER).

Applications are invited from suitably qualified young men who are interested in power station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £540-£730 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 25th June, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

5th June, 1958. 3787

JOSEPH LUCAS
(ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

CORPORATION OF THE CITY OF ABERDEEN

Lighting Department

APPLICATIONS are invited for the post of TECHNICAL ASSISTANT in the above Department at a salary within Grade C.S.8 (£665 to £715). Particulars as to the appointment may be had from the Superintendent of Lighting, 262, King Street, Aberdeen, with whom applications should be lodged.

J. C. RENNIE,
Town Clerk.

Town House,
Aberdeen.
21st May, 1958. 9378

CENTRAL ELECTRICITY GENERATING BOARD

Mechanical Engineer, Research Laboratories

MECHANICAL ENGINEER required in the Mechanical Engineering Section of the Research Laboratories, Leatherhead, Surrey, to assist in research on the vibration and fatique characteristics of steam turbine blading and heat exchanger tubing. The successful candidate will be required to design his own rigs and develop his own instrumentation. A man with both theoretical and practical engineering ability is required. Candidates should have a degree in engineering or equivalent, and preferably some industrial experience.

Salary within scales £820-£995 or £1,055-£1,265 p.a.

Applications stating age, qualifications, experience, present position and salary to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 24th June, 1958. Envelopes should be marked "Confidential," quoting reference ER/149. 3761

ELECTRICITY CORPORATION OF NIGERIA

APPLICATIONS are invited for the post of :—

INSTRUMENT ENGINEER

Applicants, who should not be more than 45 years of age, must have had sound practical experience on this type of work. Ability to install, service and calibrate all instruments and gauges as fitted to modern water tube boilers; draught control, turbo-alternator and diesel generator control panels is essential. The duties of the appointment will include regular visits to power stations throughout the country on this type of work.

Salary in scale £930 - £1,074 per annum plus inducement addition of £240 - £270 per annum according to experience.

This appointment will be on contract terms of one or two tours of not less than 18 months' continuous service. The post carries an additional contract allowance of 10% of the basic salary and a lump sum gratuity of 25% of the total emoluments (excluding contract allowance) at the conclusion of the contract. An outfit allowance of £60 is payable on appointment.

First class passages are provided with special passage arrangements and allowances for the officer's wife and up to two children.

Quarters with hard furnishings will be provided at a low rental.

Further particulars and application forms may be obtained on request from the Resident Engineer, Electricity Corporation of Nigeria, Nigeria House, Northumberland Avenue, London, W.C.2.

3719

AIR MINISTRY

WORKS Design Branch requires in LONDON and PROVINCES ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in London up to £870 p.a. Somewhat lower in Provinces. Starting pay dependent on age, qualifications and experience. Long-term possibilities with promotion and pensionable prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. BOROUGH 104. 253

SOUTH SHIELDS EDUCATION AUTHORITY

Marine and Technical College

Principal :
J. Hargreaves, M.A., Ph.D.(Cantab), J.P.

APPLICATIONS are invited for the following appointments from September, 1958, or as early as possible thereafter :—

1. MATHEMATICS AND SCIENCE DEPARTMENT : GRADE B ASSISTANT LECTURER. Applicants should be graduates qualified to teach Physics and Mathematics.
2. ELECTRICAL ENGINEERING DEPARTMENT: GRADE A ASSISTANT LECTURER. University degree or equivalent is essential as well as good industrial experience.

The salary for each of the above posts will will be in accordance with the Burnham Scale for Teachers in Institutions of Further Education, and appropriate allowances will be given for industrial experience, degree, training, etc.

Application forms may be obtained from the Education Office, Westoe Village, South Shields. Completed applications should be sent to the Principal of the College, St. George's Avenue, Westoe, South Shields, within two weeks of the appearance of this advertisement. 3774

ASSISTANT ELECTRICAL ENGINEER

required at the

EBBW VALE SECTION

of

RICHARD THOMAS & BALDWINS LIMITED

Candidates should be between 25 and 35 years of age, and should hold the Higher National Certificate in Electrical Engineering. An interest in the application of modern maintenance methods to a wide variety of electrical equipment in a large integrated iron and steel works is desirable.

Salary commensurate with qualifications; Superannuation scheme. The company will assist with housing.

Applications will be treated as strictly confidential, and should be addressed to the—

Chief Engineer
RICHARD THOMAS & BALDWINS LIMITED
Ebbw Vale, Mon.

3788

SPECIAL-PURPOSE COMPUTERS

THE Kidsgrove Works of the ENGLISH ELECTRIC COMPANY is considerably expanding its activities in the field of Special-Purpose Digital Computers, and is building new development laboratories pleasantly located on the Staffordshire/Cheshire border. There are a number of vacancies for SENIOR ENGINEERS in the Computer team.

Candidates should have had experience of logical and circuit design of computers, but consideration will be given to candidates having experience in the design of other complex pulse circuitry.

Attractive staff pension scheme and three weeks' holiday next year. Unfurnished tenancy of recently built houses will be available after an initial period.

Please write giving full details to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting Ref. ER.306K.

3753

Situations Vacant (continued)

COMPUTER ENGINEER

BOOTS PURE DRUG Company Limited wish to appoint a graduate engineer, preferably under 35 years of age, with an honours degree in light current engineering or allied subjects and experience in electronic data processing or some related field.

The Company is embarking on the installation of an extensive commercial electronic data processing system. Equipment on order includes a large scale general purpose digital computer, a special purpose electronic sterling accumulator, and a wide range of peripheral equipment including a character recognition device. The system is due for installation during 1959. Development of the data processing centre is expected to continue for some years.

The successful candidate will be responsible for liaison with the manufacturers before and during the installation period. He will be required to set up a small specialist team for the testing and maintenance of the equipment now under development and construction at the makers' works and for the co-ordination of these projects from the engineering and maintenance viewpoint. Training, as necessary, will be arranged for the selected candidate. The post is a senior one and the computer engineer will be responsible directly to the chief engineer. A generous salary will be paid commensurate with qualifications, age and experience.

Applications should be submitted by the 30th June to the Personnel Manager, Boots Pure Drug Co. Ltd., Station Street, Nottingham.

3805

THE GENERAL ELECTRIC COMPANY LIMITED

Witton, Birmingham, 6

YOUNG qualified electrical engineers required for work in connection with the preparation of tenders for plant and associated control gear.

The work is interesting and covers a wide field involving steel works, mining and industrial plant installation, and provides a good opportunity for young men of initiative to widen their experience and attain senior status.

Applicants should possess H.N.C. (Electrical) or equivalent, together with some knowledge of estimating and tendering.

Interviews in the strictest confidence will be arranged at any time to suit the convenience of applicants.

Adequate assistance is available to cater for change of district. Generous salary levels are offered.

Salary at commencement depending on qualifications and experience.

Please apply with full particulars to

The Staff Manager

3754

ASSISTANT CHIEF ELECTRICAL ENGINEER

OPPORTUNITY in Glasgow for young man, aged 25/30, with experience in A.C. motor design to assist Chief Electrical Engineer.

This post covers a wide variety of work both on design and development of A.C. rotating machinery and also of factory installation.

Applications should state technical qualifications, age and previous experience. Good pension scheme coupled with free life assurance; canteen; sport and social facilities.—Box 3674.

CENTRAL ELECTRICITY GENERATING BOARD

APPLICATIONS are invited for the following posts at Headquarters in London :—

(a) ASSISTANT CHIEF CONTRACTS OFFICER (Ref. ER/154).

The successful candidate will be responsible to the Chief Purchasing and Contracts Officer for implementing the Board's purchasing policy and for the negotiation of major contracts for mechanical and electrical plant and civil engineering and building work. Applicants must have had extensive experience in a large organisation of the type of contract placed by the Board and be capable of undertaking commercial negotiations at a high level.

(b) ASSISTANT CHIEF PURCHASING OFFICER (Ref. ER/155).

The successful candidate will be responsible to the Chief Purchasing and Contracts Officer for implementing the Board's purchasing policy and for major negotiations conducted by headquarters. Applicants should be fully qualified in all aspects of purchasing engineering and other supplies for a large organisation and experienced in the management of stores and in methods of stock control.

Salaries for both appointments will be within the provisional range £3,410-£3,635 p.a.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, Central Electricity Generating Board, 24-30, Holborn, London, E.C.1, by 27th June. Please mark envelopes "Confidential" and quote relevant reference number. 3817

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

(A) SHIFT CHARGE ENGINEER, KINGSTON "B" POWER STATION.

Applicants should preferably possess H.N.C. or equivalent qualification and must have had extensive experience in the operation of modern high pressure turbine and boiler plant, E.H.T. switchgear and in the control of labour.

Salary Class G, Grade 7, £1,078 10s. to £1,144 10s. per annum including 10% shift allowance and London allowance.

(B) FOURTH ASSISTANT ENGINEER, CROYDON DISTRICT.

Applications are invited for the post of Fourth Assistant Engineer in the Technical Department Measuring Section based at Croydon. Applicants should have a sound knowledge of metering and instrumentation techniques and preference will be given to candidates with experience in Class A polyphase test room work.

Salary Class AX/DX, Grade 8, £750-£960 per annum including London allowance.

Applications giving details of education, present position, experience, etc., should be sent according to location to (A) Station Superintendent, Kingston "B" Power Station, Down Hall Road, Kingston-on-Thames, and (B) to Establishments Officer, Central Electricity Generating Board, Lower Ham Road, Kingston-on-Thames, so as to arrive by 25th June, 1958, quoting reference (205). 3820

WELSH COLLEGE OF ADVANCED TECHNOLOGY

Cathays Park, Cardiff

Principal : Dr. A. Hervey, B.Sc., F.Inst.P.

ELECTRICAL ENGINEERING DEPARTMENT

APPLICATIONS are invited for the following posts :—

LECTURER. Salary £1,200 × £30 to £1,350 p.a.

ASSISTANT LECTURER (GRADE B). Salary £650 × £25 to £1,025 p.a., with allowances for training, industrial and teaching experience.

Applicants should be well qualified to teach in the field of Heavy Current Electrical Engineering to the standard of Part III I.E.E. and Dip. Tech. (Eng.).

Application forms (together with further particulars) may be obtained from the Principal, to whom they should be returned as soon as possible.

ROBERT E. PRESSWOOD,
June, 1958. Clerk to the Governors.

3792

CITY AND COUNTY OF KINGSTON UPON HULL

City Engineer's Department

Street Lighting Assistant

APPLICATIONS are invited for the appointment of STREET LIGHTING ASSISTANT. Salary within the Special Grade £750/£1,030.

Preference will be given to candidates who have had electrical training and experience in the design and erection and control of all types of street lighting installations and the control and supervision of maintenance work by direct labour.

Housing accommodation will be provided for the successful married candidate if not already resident within the city.

Applications on forms which can be obtained from the City Engineer, Guildhall, Kingston upon Hull, accompanied by copies of testimonials, are to be returned not later than a fortnight after the appearance of this advertisement.

WM. MORRIS, O.B.E.,
Guildhall, City Engineer.
Kingston upon Hull. 3773

AIRCRAFT EQUIPMENT

MECHANICAL AND ELECTRICAL ENGINEERS are required by the ENGLISH ELECTRIC COMPANY for the expanding Aircraft Equipment Division.

Vacancies exist in the following engineering and design fields :—

A.C. AND D.C. MACHINES.
GENERATING SYSTEMS.
HYDRAULIC MECHANISMS.
RELAYS AND CONTACTORS.
PROTECTIVE SYSTEMS.

Positions are pensionable and on the permanent staff. We have a comprehensive sports club, including a golf course. Housing assistance may be provided where necessary, and shortly there will be some company houses available. Salaries will be discussed at an interview when all factors will be considered; they are reviewed annually.

Applications at all levels and ages will be carefully considered and confidential enquiries will be honoured in the initial stages.

Please reply to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting reference ER.210H.

3816

TECHNICIAN

required by

THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKSHIRE,

to act as a member of a shift pool supervising the operation and maintenance of electrical and mechanical plant and equipment, including maintenance of technical records and routine inspection of equipment, sometimes involving wearing of protective clothing. Plant includes electrical and domestic services. A recognised engineering apprenticeship and a working knowledge of some of the equipment required. O.N.C. or equivalent qualification desirable, also experience of engineering shift work in charge of ventilation plant and domestic services.

SALARY £755 (at age 28 or over) to £875 per annum.

Contributory superannuation scheme. A house or assistance towards legal expenses on house purchase will be available for married officers living beyond daily travelling distance.

POSTCARDS for application forms to the Senior Recruitment Officer at above address. Please quote ref. A/1730/48.

3752

MIDDLESEX COUNTY COUNCIL

Education Committee

BRUNEL COLLEGE OF TECHNOLOGY
Woodlands Avenue, Acton, London, W.3

APPLICATIONS are invited for the post of:—

ASSISTANT, GRADE B, in ELECTRICAL ENGINEERING.

Candidates should be graduates or possess professional qualifications and have experience in teaching or industry. The department provides courses leading to the Diploma in Technology, B.Sc.(Engineering) and Higher National Certificate. Research by members of the staff is encouraged.

Salary in accordance with the Burnham (Technical) Report 1956, i.e. £650 × £25 to £1,025, plus London allowance and other additions for previous experience as appropriate.

Application forms and further particulars (stamped addressed foolscap envelope) from the Principal to whom completed forms should be returned within 14 days of the appearance of this advertisement.

C. E. GURR, M.Sc., Ph.D.,
Clerk to the Governing Body.
3808

ELECTRICAL ENGINEER
A.M.I.E.E.

required for world-wide organisation designing and constructing plant for :—

FUEL GAS PRODUCTION.
BULK HANDLING OF MATERIALS.
CHEMICAL ENGINEERING PROCESSES.
NUCLEAR POWER
and
UNDERGROUND GASIFICATION OF COAL.

The successful applicant would join a team of electrical engineers engaged in the design, contracting and commissioning of electrical installations associated with the above projects. Apply in writing to :—

A. C. Stock
HUMPHREYS & GLASGOW LTD.
22, Carlisle Place
London, S.W.1

3789

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable appointment:—

FOURTH ASSISTANT ENGINEER (Protection), TECHNICAL SECTION, CHIEF ENGINEER'S DEPARTMENT.

Candidates should possess a Degree or Higher National Certificate in Electrical Engineering and should have had experience in commissioning high-voltage electrical apparatus and routine testing and maintenance of protective gear. Preference will be given to candidates with previous experience at the works of a manufacturer of the above equipment.

The position is located at Portobello.

Salary £710/£935 per annum in accordance with Class AX/EX, Grade 8 of Schedule B to the National Joint Board Agreement.

Apply quoting Reference No. E13/58 on standard form AE.6, available from the Secretary, P.O. Box 173, 351, Sauchiehall Street, Glasgow, C.2, not later than Friday, 27th June, 1958. 3810

SALES MANAGER

ELECTRICAL wiring accessory company requires a live man for the above position. Must possess good personality, initiative, be able to expand sales through existing representatives and agents. A high salary will be paid to suitable person.

Applications will be received in strict confidence and should include full details of the candidate's career, together with salaries received.—Box 3688.

SOUTH EASTERN ELECTRICITY BOARD

SHOWROOM ASSISTANT (Male), Croydon and Purley District.

Salary £410 at age 21 to £605 according to age and qualifications. Superannuable. Duties include sale of appliances and cashier work in any showroom within the Croydon and Purley district.

Application forms from Croydon and Purley District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 25th June, 1958.

SENIOR DRAUGHTSMAN, Croydon and Purley District.

Salary £945-£1,045 p.a. (including London Area allowance) under N.J.B. Schedule D, Grade 4. Superannuable.

Applicants should be suitably qualified and capable of supervising a large district drawing office under the District Engineer. Experience in basic design, layout of substations up to 11 kV, presentation of data and mains and system records is essential.

Applications, naming two referees, on forms from Croydon and Purley District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 25th June, 1958.

G. WRAY,
Secretary.
3811

WAR DEPARTMENT

Glasgow Area

Clerk of Works (Electrical)

CLERK OF WORKS (Electrical) required by W.D. at Glasgow. Applicants must be of British parentage and possess the following qualifications : Ordinary National Certificate in Electrical Engineering or evidence of equivalent standard of technical education, and five years' apprenticeship or equivalent with an engineering concern giving good comprehensive training. Completion of course at S.M.E. required for appointment to Establishment for Engineering Services as Clerk of Works (Electrical) constitutes equivalent qualification. In addition must have following experience : After completing apprenticeship at least three years with an engineering firm giving good comprehensive experience or three years' service as Supervisor of Labour, Chargehand or Technical Officer in the engineering industry.

Salary assessed according to age, qualifications and experience on national range of £675 (at age 26) to £845 per annum. Post is temporary but with long-term possibilities.

Applications to C.R.E. Lowlands, 12, Park Circus, Glasgow, C.3. 3801

TECHNICAL INSTRUCTOR (ELECTRICIAN)

required by GOVERNMENT OF NORTHERN REGION, NIGERIA, for two tours of 18/24 months or three tours of 10/12 months either (a) on agreement with prospect of permanent and pensionable employment in salary scale (including inducement addition) £750 rising to £1,284 a year, or (b) on contract in salary scale (including inducement addition) £810 rising to £1,386 a year, with resettlement grant at rate of £100/£150 a year. Clothing allowance £45. Free passages for officer and wife. Assistance towards cost of children's passages and grant up to £288 annually. Liberal leave on full salary.

Candidates must have served full apprenticeship and possess Final C. and G. Certificate. They must be practical tradesmen with experience of domestic installation work and the installation and maintenance of generating units. Apprentice training or other teaching experience desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/41933/EF. 3759

WINDING SHOP SUPERVISOR

SUPERVISOR required to control the winding section of a progressive electrical repair works employing about 40 male and female winders, including apprentices.

Wide experience essential on A.C. and D.C. work. An interesting and well-paid post with good opportunities for a man with energy and initiative.

Full particulars to M.E.I. Co. Ltd., Upper Villiers Street, Wolverhampton. 3734

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Area Headquarters

THIRD ASSISTANT ENGINEER
(Tariffs and Economics) (64/58.R).

Candidates should have a general experience of electricity tariffs for all classes of consumers and some knowledge of the economics of the electricity supply industry. Experience of utilisation research and simple statistical method is desirable. Appropriate engineering or economic qualifications would be an advantage.

Salary N.J.B. Class AX/EX, Grade 5, commencing within the range of £1,055-£1,180 on Class AX.

Apply by letter, within 14 days, to the Chief Commercial Officer, Eastern Electricity Board, P.O. Box 40, Wherstead, Ipswich, Suffolk.

Suffolk Sub-Area

THIRD ASSISTANT ENGINEER
Stowmarket District (63/58.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems (including substations) at voltages up to and including 33 kV.

Salary N.J.B. Class E, Grade 9 (£740-£785).

Apply by letter, within 10 days, to G. N. H. Mayes, T.D., A.M.I.E.E., Manager, Stowmarket District, Eastern Electricity Board, 25, Ipswich Road, Stowmarket, Suffolk. 3823

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

125

WELL-KNOWN COMPANY REQUIRES A MANAGER

THOROUGHLY experienced MANAGER, with industrial and dealer experience and contacts, for PORTABLE ELECTRIC TOOL DIVISION of well-known company.

Good salary, share in profits, and car.

Box 3775

BOROUGH OF POOLE

Electrical Engineering Assistant
Grade A.P.T.I. £575-£725

APPLICATIONS invited from trained engineers, H.N.C. standard, for design work on internal and external installations in engineering and architectural works programme. Forms and details from Borough Engineer, Poole, Dorset.

J. G. HILLIER,
Town Clerk.
3822

Situations Vacant (continued)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

APPLICATIONS are invited for the following positions:—

ASSISTANT ENGINEERS (Grade 10), MARCHWOOD GENERATING STATION (S/13.1007).

The new Marchwood generating station is situated near Southampton. Those appointed may be required to undertake shift operational duties, to assist on maintenance work, or to perform general station duties. Previous experience of modern generating station plant is desirable. Applicants should have had a sound technical training and should possess qualifications leading to corporate membership of an appropriate professional institution, or hold equivalent qualifications.

Salary N.J.B. K/10, £935-£995.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 25th June, 1958. 3819

BIRKENHEAD EDUCATION COMMITTEE

Birkenhead Technical College

Principal: C. V. Vinten Fenton, M.Sc., A.M.I.Mech.E., A.M.I.E.E.

APPLICATIONS are invited for the following appointment to the full-time teaching staff :—

ELECTRICAL ENGINEERING DEPARTMENT.

ASSISTANT GRADE A for Installation Work and Electrical Technicians' Subjects. Salary in accordance with the Burnham Technical Report, 1956.

Further particulars and forms of application may be obtained from the undersigned, to whom completed applications should be returned by 15th June, 1958.

H. GLYN WILKINSON,
Director of Education.

63, Hamilton Square,
Birkenhead. 3790

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Corporate Membership of I.E.E. or I.Mech.E. an advantage.

SHIFT CHARGE ENGINEER,
HACKNEY POWER STATION
(Vacancy No. 58/408).

Sound technical training, preferably to H.N.C. standard, and practical experience of operation and control of power station plant. Character and ability to supervise staff is important. Salary Class H, Grade 7 = £1,045 plus £99 10s. shift p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 23rd June, 1958. 3771

SOUTHERN ELECTRICITY BOARD

General Assistant Engineer

SUB-AREA Engineering Department (Meter Section) of No. 1 (Southall) Sub-Area, located at Waterloo Road, Uxbridge, Middlesex. Salary N.J.B. Class L, Grade 16 (£725-£770 per annum inclusive of London allowance. N.J.B. conditions of service.

Applicants should have experience in three-phase meter testing, instrument transformer testing, assisting in the standardising of watt-meters and the commissioning of special equipment.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.902, in envelopes suitably endorsed, not later than 30th June, 1958. 3802

COLLEGE OF TECHNOLOGY BIRMINGHAM

(Designated College of Advanced Technology)

Department of Electrical Engineering

APPLICATIONS are invited for the following posts:—

SENIOR LECTURER.
LECTURER.
ASSISTANT GRADE B.

Salary Senior Lecturers (Men), £1,350 × £50 to £1,550; Lecturers (Men), £1,200 × £30 to £1,350. In fixing the commencing salary, account may be taken of industrial, professional or research experience up to the maximum of the scale.

Assistants Grade B (Men), £650 × £25 to £1,025 with additional graduate and training allowances where applicable. In fixing the commencing salary account will be taken of teaching and industrial experience.

Further particulars and forms of application from the Registrar, College of Technology, Gosta Green, Birmingham, 4, on receipt of stamped addressed foolscap envelope. Applications to be received within 18 days of this advertisement.

K. R. PILLING,
Clerk to the Governing Body.
3821

CENTRAL ELECTRICITY GENERATING BOARD

Yorkshire Division

APPLICATIONS are invited for an appointment as FOURTH ASSISTANT ENGINEER in the Technical Department based on Keadby, Nr. Scunthorpe.

Commencing salary within the range £710-£835 per annum, Class AX, Grade 8, according to qualifications and experience, rising to an ultimate maximum of £935 per annum (Class EX).

Applicants should possess technical qualifications leading to Corporate Membership of the Institution of Electrical Engineers and should have had some experience of protective equipments applied to high voltage generation and transmission systems. Works experience will be an advantage.

Application forms obtainable from the Divisional Secretary (Establishments), Central Electricity House, St. Mary's Road, Leeds, 7, to be returned within 14 days of the appearance of this advertisement. 3818

LONDON ELECTRICITY BOARD

Vacancies: Draughtsmen

APPLICATIONS are invited for the above positions in the Board's Northern District at Clapham, London, E.5.

Applicants should be not less than 21 years of age and have had some experience in mains recording with a public utility authority, preferably with an electricity board, and be able to obtain particulars on site and compile neat and accurate permanent records.

The posts are graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 2, £615-£675 per annum, plus the appropriate London Area allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 23rd June, 1958. Please quote ref. PER/2486/R. 3791

ENGLISH ELECTRIC VALVE COMPANY CHELMSFORD

require

TECHNICAL ASSISTANTS

with education to H.N.C. (Electrical) standard for work in departments concerned with semi-conductors, travelling wave tubes and new developments in the field of vacuum physics.

Age range 25-30.

Applications should be submitted to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting ref. ER.1506N.

3672

LONDON ELECTRICITY BOARD

General Assistant Engineer

APPLICATIONS are invited for the above position in the Board's South Western District at Battersea.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the electricity industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £590 per annum rising to £725 per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 19th June, 1958. Please quote ref. PER/2471/R. 3671

FEDERATION OF RHODESIA AND NYASALAND

Vacancy: Assistant Electrical Engineer, Public Works Department

APPLICANTS must be A.M.I.E.E., or hold or obtain this year a degree in Engineering which exempts from the Graduate Examination of the United Kingdom Institution of Electrical Engineers.

Starting salary: £900-£1,250 depending on qualifications and experience on scale £700 × £100 to £1,100 × £75 to £1,250 × £50 to £1,650. The successful applicant will be stationed in Salisbury.

Application forms and further details from Secretary (R), Rhodesia House, 429, Strand, London, W.C.2. Closing date 5th July. 3814

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Electrical) is required at Hams Hall "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K8, £1,065-£1,140 per annum.

Applicants should have received a sound technical training and practical experience in electrical maintenance in a modern power station, and the possession of an appropriate technical qualification will be an advantage.

Apply, quoting Vacancy No. 811MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 26th June, 1958. 3770

SIMON HANDLING ENGINEERS LTD.

requires an

ELECTRICAL CONTRACTS ENGINEER

also a

DRAUGHTSMAN

experienced in control gear, wiring diagrams, and cable planning for factory installations. Write stating age, qualifications and experience to

Personnel Department, Ref. RO.38,
Simon Handling Engineers Ltd.
Cheadle Heath, Stockport, Cheshire

3806

M.K. ELECTRIC LIMITED

require an

EXPERIENCED SALES REPRESENTATIVE

for

CLYDESIDE & SOUTH-WEST SCOTLAND

THE successful candidate will be required to live in Glasgow. If you have experience in dealing with architects, electrical wholesalers and contractors, are a car owner, and would like to join the sales team of a progressive company marketing products with a world-wide reputation, we would like to hear from you in confidence. Write in the fullest detail to :—

The Sales Manager, M.K. Electric Ltd.
Wakefield Street, London, N.18

3807

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 2 Sub-Area

ASSISTANT CONSUMERS' ENGINEER required in the Runcorn District. Salary within range £540/£585 per annum (N.J.B. F/14).

Duties of the post will include estimating for contracting work, and advising consumers on matters relating to electricity supply and the utilisation of electrical equipment.

Applicants should have received an engineering training. A technical qualification is desirable.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire. Closing date 25th June, 1958. 3813

A VACANCY occurs in our technical and estimating office for a man experienced in the various types of rotating electrical machines up to 15 kW. A general knowledge of control gear will be considered an advantage. Reply in writing, giving experience, age, etc., to—W. Mackie & Co. Ltd., 129/133, Lambeth Rd., London, S.E.1. 3793

A YOUNG man with commercial outlook and sound electrical engineering background is required for interesting work in the sales and design department of an expanding organisation manufacturing selenium metal rectifiers, transformers and equipment. Previous experience in this field is not essential. Applicants possessing a sound technical education would be preferred, together with an ability to correspond in good English. Apply—Automat Ltd., Moorside Rd., Swinton, Manchester (Tel. Swinton 4242). 3776

ASSISTANT engineer required for design and circuit layout of automatic electric control equipment. Apply to — Control Gear Division, Electro Dynamic Construction Co., Bristol Road, Bridgwater. 3596

CABLE works production controller required in the North-West. Existing staff are aware of this vacancy, which calls for administrative experience in cable production. The man selected would be a key member of the works management team and it is anticipated that the right man would carry increased responsibility in two or three years' time. Applications, to the Works Director, will be treated in strict confidence.—Box 3777.

CHARGEHAND required to take charge of electrical section in small but progressive company. Wide practical experience required in repair and rewinding of motors, transformers and switchgear up to 400 kVA; panel wiring and production experience would be useful but not essential. Apply the Secretary, Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 3832

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Good salary. Permanent and progressive position. Canteen, pension scheme. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 273

DESIGN draughtsmen. Men with a flair for original and imaginative developments in the light electro-mechanical field. An expanding concern now has additional vacancies carrying top salaries and excellent prospects for men of ability and experience. Modern working conditions with canteen. Sports and social facilities. Pension scheme. Write in first place to the Chief Draughtsman, Sangamo Weston Ltd., Great Cambridge Road, Enfield. 3658

DESIGNER/draughtsman required wth experience in small electro-mechanical mechanisms. Knowledge of presswork and plastic mouldings essential. H.N.C. in physics or electrics desirable. Salary according to experience.—Box 3755.

DRAUGHTSMAN required at consulting engineers' Glasgow office to assist on layout of 132-kV substations. Prospects of future promotion to engineer. Age 20-28 years. Training for H.N.C. essential. Holiday commitments honoured. Interviews Glasgow or London. Write to Kennedy & Donkin (D.S.H.), 4, Somerset Place, Glasgow, C.3. 3825

DRAUGHTSMEN for South Manchester office. Interesting work on layouts and diagrams, 33 and 11-kV switchgear, transformers, cables, etc. Apply—South Wales Switchgear Ltd., 3, Hawthorn Lane, Wilmslow, Cheshire. 3701

DRAUGHTSMAN required for work on medium and large power transformers, voltage rating up to 132 kV. Applicants should preferably have O.N.C. and have served a recognised engineering apprenticeship. Minimum age 27 years. Position is permanent and progressive. Assistance will be given in re-housing. Apply stating experience and salary required to—Denis Ferranti Co. Ltd., Royton, Oldham, Lancs. 3710

ELECTRICAL engineer required by electrical contracting company for service in British West Africa. Experience in preparing specifications, estimating and control and supervision of contracts essential. Remuneration £1,400 to £1,500 p.a. according to qualifications and experience. Tours 20 months followed by 4 months' leave. Free passages and furnished quarters. Pension scheme and family allowances. Please write giving age, marital status and brief details of education and experience to—Box 3756.

ELECTRICAL engineer required for sales office, manufacturers West of London. Quotation and scheme preparation for automatic electrical equipment. Age 27-35. Salary £900 with prospects. Write in confidence—Box 3826.

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ENGINEER required to be responsible for the electrical installation in major development schemes. Applicants should possess H.N.C. in mechanical or electrical engineering and have experience in the design and installation of mechanical handling plant. Written applications containing full details should be made to the Development Manager, Tarmac Roadstone Limited, Ettingshall, Wolverhampton. 3778

ESTABLISHED E.W.F. wholesaler shortly opening branch North of Birmingham requires an experienced representative, with a strong connection amongst industrial users, contractors, etc., to cover city centre and an area north of Birmingham. Only applicants with commercial experience and first-class connections will be considered for this position, which carries a high salary and eventually promotion to branch manager.—Box 3827.

ESTIMATING engineer (assistant) for contractor's office in London. Full details of experience and salary required to Requirements Electrical & Engineering Ltd., 9, Great Newport St., London, W.C.2. Envelope addressed to Managing Director. 3829

EXPERIENCED draughtsmen of O.N.C. or H.N.C. standard required for interesting design work on process plant and machinery. A good technical background and knowledge of machine design is essential and applicants should be qualified to H.N.C. standard. Salaries are assessed in accordance with age, qualifications and experience and will be reviewed annually. The salary at 25 for those with H.N.C. is £750 p.a. Contributory superannuation and widows' pension fund are in operation and there are excellent canteen, welfare and recreational facilities. Applicants should apply in writing to Group Personnel Department, Pilkington Brothers Limited, Grove Street, St. Helens, enclosing a brief history of their career and details of their education and qualifications. 3720

FOREMAN and C.H. electricians required. Permanent type installations and maintenance of electrical plant on civil engineering contracts. Armoured cable, conduit, P.V.C., etc. Write stating age, experience, etc., to—Box 3779

HEAD storekeeper required by E.W.F. wholesaler to take charge of new branch North of Birmingham. Excellent opportunity for a fully experienced man able to control branch activities. Must be of smart appearance and have good personality to command. High salary envisaged.—Box 3828.

INSULATION engineer required by a research organisation in the South of England. Applicants should preferably have an honours degree and have had experience in the design and application techniques of insulation materials for a wide range of electrical equipment. The position offers considerable scope to a young and energetic engineer. Excellent working conditions, canteen facilities, superannuation.—Box 3794.

JUNIOR designer, male or female, required for the transformer design office dealing with a wide range of problems from instrument transformers to power transformers and associated equipment. Apply giving details of past experience, age and salary to — Personnel Officer, Foster Transformers Ltd., South Wimbledon, London, S.W.19. 3619

JUNIOR electrical engineer required to deal with detailing of specifications for distribution and control panels, general technical sales, etc. Works experience essential. Good opportunity for young engineer with technical background and an aptitude for office work. Apply the Secretary, Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 3833

JUNIOR estimating and contracts engineer required for expanding switchgear company. Must have H.N.C. or equivalent. Previous experience in preparation of composite tenders for electrical switchgear essential. Apply giving age, salary required and full details of experience to date to — Reference AWB, Switchgear & Equipment Ltd., Banbury, Oxon. 3738

KARACHI. The General Electric Co. Ltd. has a vacancy for an engineer to be responsible for the general contract department in its branch in Karachi. A wide experience in handling electrical contracting work is essential. The post is permanent, the length of the first tour being 3½ years followed by 6 months' leave. Applicants should write to the Staff Manager G.E.C., Magnet House, Kingsway, London, W.C.2 (Ref. KC), giving details of age and experience. 3795

NEWSPAPER office, Manchester, requires electrician for maintenance modern newspaper plant. Must have fundamental knowledge and extensive experience industrial electronics, both light and heavy power equipment. Rapid fault rectification on complex remote control systems essential. N.P.A. rates and conditions, E.T.U. Write stating age, full details experience and training.—Box 3796.

POWER generation. Senior engineer as head of power generation branch required in National Coal Board's production department at London H.Q. Wide experience essential in the preparation of specifications for equipment associated with steam generating plant, negotiating with contractors prior to the placing of contracts and supervising projects from a head office, together with a knowledge of transmission and distribution systems and of electricity supply tariffs. Salary (superannuable) according to qualifications and experience, but not less than £2,000 p.a. Write with full particulars to Staff Dept. (X1173), N.C.B., Hobart House, Grosvenor Place, London, S.W.1, before 25th June, 1958. 3797

PRODUCT design draughtsmen required for light engineering products. 5-day week. Pension schemes. Reply, giving full particulars of experience, age and salary required, to—Labour Manager, Parnall (Yate) Limited, Yate, Nr. Bristol. 3692

PRODUCTION engineer with full knowledge of manufacture of selenium plates abroad required urgently.—Box 9389.

PUBLICITY and sales promotion. An enthusiastic young man under 35 is required by a Birmingham electrical manufacturing organisation to take an active leading position in the sales department. Applicants should have an interest in general publicity matters, have an engineering background, and be willing to train for a limited period with the company's products.—Box 3694.

REPRESENTATIVE required with real live connections amongst factories, stores, contractors, etc., in London and Home Counties, by old-established E.W.F. electrical wholesaler. Excellent prospects, own car an advantage, good salary, all expenses and commission. Write in confidence stating age and experience to—A. S. Duran & Co. Ltd., 30, Kings Road, Reading. 3830

SALES engineer required by The Sun Electrical Co. Ltd. for S.E. London and East Kent area, to cover industrial concerns. Experience in wholesale trade essential. Write in first instance, giving details in confidence of age, past experience and level of earnings over past 5 years, to—Sales Manager, 118/120, Charing Cross Road, London, W.C.2. 3764

SENIOR cable estimator required by Hackbridge Cable Co. Ltd., Hackbridge, Surrey. Must be fully conversant with estimating and design for paper, rubber and thermoplastic cables. Pensionable post. Write stating age, experience and salary required. For the attention of the General Sales Manager. 3721

***Situations Vacant** (continued)*

SENIOR draughtsmen required, experience in the design of automatic electric control and/or switchgear essential, preferably also familiar with British Admiralty and marine requirements. Rates above A.E.S.D. according to experience; good conditions; varied and interesting work. Apply in confidence to—Electro Dynamic Construction Co. Ltd., Control Gear Division, Bristol Road, Bridgwater, Somerset. 3702

SENIOR electrical engineer, 30/40 years, required as general assistant to general manager of firm engaged in the manufacture of electrical space heating equipment. London area. This is a responsible position and calls for a qualified engineer with good commercial background and administrative ability. Attractive salary and prospects. Applications are invited with full particulars to—Box 3781.

SENIOR sales engineer required in the London area by established electric motor manufacturers. Real opportunity for a man with experience and progressive outlook.—Box 3695.

SENIOR transformer draughtsman with experience of distribution transformers up to 1,000 kVA. Permanent and progressive position. London area.—Box 3763.

SMITH METERS Ltd. require technical assistant to sales manager, able to handle correspondence, quotations, etc. Applications to—Sales Manager, Smith Meters Ltd., Rowan Road, Streatham Vale, London, S.W.16. 3780

SWITCHGEAR engineer responsible to the manager for all technical decisions in connection with design and application, including protection, for a manufacturer's range of switchgear including L.V. air and oil break gear and H.V. switchgear up to 33 kV. Reply in the first instance outlining qualifications, experience and salary to—Box 370.

TECHNICAL estimator required for responsible position in small electrical manufacturing unit in North London dealing with a range of medium duty switchgear, switchboards, sheet metal work, etc. Experience of shop floor techniques and customer contact advantageous, together with qualifications to Higher National Certificate standard. Attractive salary and pension scheme.—Box 3765.

TELECOMMUNICATIONS sales engineers. Delegate sales engineers reqd. for important overseas appointments. Essential qualifications are wide telecommunications experience especially in telephone switching field, a knowledge of systems in use throughout the world, negotiating ability, and aptitude for foreign languages. Education to B.Sc. standard with A.M.I.E.E. and specialised C. and G. Certificates. Age range 30 to 35. Physical fitness essential. Generous salaries and overseas allowances. Local leave and periodic passage-paid home leave for engineers and family. Company pension scheme. Suitable commercial training will be given before posting overseas. Written applications, with small recent photograph, should be made in confidence stating age, education, experience and present salary, to—Staff Officer, Ref. 744/15, Siemens Edison Swan Ltd., Woolwich. London, S.E.18. 3766

TRANSFORMERS & RECTIFIERS Ltd., Millmead, Guildford, Surrey, require juniors for test dept. and drawing office Good training and excellent prospects. Holiday arrangements respected. State age, salary required and experience when replying. 3743

VACANCIES occur in a consulting engineers' office for junior and senior draughtsmen with experience in lighting and power installations in buildings. The posts offer opportunity for gaining experience in mechanical services also, and are progressive. Good drawing and printing essential. Five-day week, usual holidays. Apply in writing stating age, training and experience to—C. MacKechnie Jarvis and Partners, 34, Victoria Street, London, S.W.1. 3767

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

ELECTRICIAN seeks overseas work. Experience on number of contracts abroad.—Box 9379.

ENGINEER, age 33, seeks position as outside representative, ten years' design experience, transformers up to 100 kVA, rectifier, and fluorescent ballast units. H.N.C. C. & G. Tech. Elect. I and II.—Box 9384.

ARTICLES FOR SALE

NEWMAN

Diesel Engines and Sets for Sale for Immediate Delivery

1,000-h.p. ENGLISH ELECTRIC 8-cylinder type 8RL Diesel Engine. Speed 575 r.p.m. Can be supplied with 900-kVA, 400-volt, 3-phase, 50-cycle Alternator if required.

110-h.p. CROSSLEY twin-cylinder Vertical Diesel Engine, type RVD.2. Speed 350 r.p.m.

493-kVA PETTER/BRUSH 6-cylinder, 600-r.p.m. Diesel Engine and direct-coupled 493-kVA, 400-volt, 3-phase, 50-cycle Alternator and Switchgear (two available).

220-kVA GENERAL MOTORS Model 8.268A, 1,000-r.p.m. Diesel Engine and direct-coupled 220-kVA, 3-phase, 50-cycle Alternator and Control Panel.

62.5-kVA PAXMAN/CROMPTON PARKINSON 5-cylinder radiator-cooled Diesel Engine, 1,000 r.p.m., and direct-coupled 62.5-kVA, 400-volt, 3-phase, 50-cycle Alternator and Control Panel.

NEWMAN INDUSTRIES LIMITED
Yate, Bristol
(Telephone: Chipping Sodbury 3311) 372

ELECTRICAL EQUIPMENT FOR SALE

NEW ALLEN WEST OIL-IMMERSED CIRCUIT BREAKERS, pedestal type, 25-amp. and 70-amp. sizes, 400/3/50; also ELLISON Bantam 20-amp. ditto.

NEW 25-kW SPARE BULBS for HEWITTIC MERCURY ARC RECTIFIERS, type 100/3. NEW MERCURY ARC RECTIFIERS, input 200-250 v./3/50, output 110 v., 2-wire.

2 NEW 3-ph. TRANSFORMERS, 500 kVA, outdoor type, 6,600/440/250, and 2 ditto, 100 kVA, 3,300/440/250.

All above available at fraction of original cost.

BURLEIGH,
Alpine Works, Empire Way, Wembley, Mdsx. 3520

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., 1s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 6373) 191

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W.4. 57

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

AUTOMATIC diesel sets, 230 v. A.C., 2, 3, 4, 6-kW Dales; 3 and 6-kW Morrisons; Lister Startomatics, 2½ kW; 15-kW Lister set, 230 v. A.C.; alternators, 2.75 kVA, 5.6 kVA, 30 kVA, 230 v., 1-ph.; 375-kVA, 750-r.p.m., 400/3/50; others. Enquiries—E. Binns, Works, 156a, Falsgrave Road, Scarborough. 9386

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

AVAILABLE immediately: One B.T.H. frequency changer, 20/25 kVA; one Wadkin 25-h.p., 440-volt, 3-phase stator unit; two Neco 23" diameter fan with 2-h.p., 400/440-v., 3-ph., 50-cycle electric motor. Apply—Leaderflush (Doors) Ltd., Trowell, Nottingham. 3636

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

B.T.H. motor alternating set on combination bedplate, comprising 6.6-kV driving motor, 710 h.p., 750 r.p.m., with exciter, direct coupled to single-phase alternator, 25 cycles, 120 volts, 4,000 amps. May be seen running at Universal Grinding Wheel Co. Ltd., Stafford. 3637

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONTROL panel with ammeters and isolating switches for operating two 75-h.p. slipring motors and four other small ones. Automatic type for P.B. remote control. Suitable for large refrigeration plant, etc.—Box 3782.

CONVERTERS and motor-alternators, 24, 110 and 220 v. D.C. to 230/1/50 A.C., 125 watts to 6 kVA in stock.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

COPPER braided tubular ½" tape, about 700 yds., new condition, 1s. 8d. per yard.—Thermega Ltd., Ermyn Way, Leatherhead, Surrey. 3798

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—F. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLAMEPROOF switchgear, lighting fittings, conduit fittings, motors, etc., always in stock.—Leighton Warehouse Co., 6, Church Road, Linslade, Leighton Buzzard, Beds. (Tel. No. L.B. 3400). 9341

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FREQUENCY changers and variable frequency M/A sets in stock, and to specification.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

ELECTRICAL equipment for sale: British Electric Transformer, 200 kVA, 6,000-400v., 50 cycles, 3-phase; James Tate 150-kVA, 6,000-v. H.T. switchgear, complete with meters. No reasonable offers refused. Offers to—Chisholm & Co. Ltd., Sefton Works, Field Lane, Litherland, Liverpool. 3704

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

GENERATING plants of all types, new and reconditioned up to 100 kVA in stock. Special plants built to order at short notice; automatic mains failure, etc. — Powerco Ltd., 312, York Rd., London S.W.18 (VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW, A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 163

HIGH frequency alternators and converters, 400 to 2,600 cycles up to 6 kVA in stock. Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 149

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., s.-ph., 50 c., 5 amps., 17s. 6d.; 1s. 6d. postage—Universal Electrical, 217-221, City Rd., London, E.C.1. 37

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTOR generators of all types in stock and to specification up to approx. 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 152

MOTORS, starters, circuit breakers. Huge stocks of all types, ¼ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

NEW electric motors for disposal. All 400/440/3/50, protected and totally enclosed. We are offering these at considerably reduced prices.—Carter & Co., Nelson, Lancs. 9385

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

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THE Seventy-ninth Annual General Meeting of W. T. Henley's Telegraph Works Co. Ltd. was held on 6th June in London.

Sir John Dalton, M.I.E.E., F.C.I.S., chairman, in the course of his speech, said :—

Although, once again, we effected an excellent turnover, profit margins declined due to higher costs and lower price levels resulting from keener competition both at home and abroad. Additionally, in the circumstances, the hampering effect of monopoly legislation was felt more acutely.

For the second year running we have found it necessary to draw upon the reserve built up to alleviate the effect of the lost sustained through the fluctuations in the price of copper. Over the year the price fell from £267 per ton to £181 10s. per ton.

Whilst these factors have affected the cable industry generally, your company had to face certain abnormal expenditures which did not improve the position for 1957. As you know, your Directors took the decision to dispose of our subsidiary—Henley's Tyre & Rubber Company—which incurred expenditures of a non-recurring nature; in particular, the restoration of the tyre company factory for the other uses to which we intend to put it.

The Accounts

The Trading Profit of the Group is £1,120,000 compared with £1,471,000 in the previous year. As I just mentioned, we again sustained losses through the fall in the price of copper and other materials, and £150,000 has been transferred from the Reserve built up for this purpose to alleviate the effect of this loss.

The Net Profit of the Group for the year amounts to £531,000, comparing with £741,000. After giving careful consideration to the Final Dividend we have proposed that the same rate should be distributed as the previous year and the one before. Nevertheless, it is necessary, I feel, to sound a note of caution. In spite of the energetic steps being taken to improve the returns from the company's business, I would not like you to take our continuation of the same level of dividend as in any way a guarantee that this will be maintained in the future. However, we are continuing to do everything possible to reduce production costs and expenses generally, so as to enable us to achieve the best possible results.

The Balance Sheet shows a sound position. In very round figures, with a Share Capital of five million pounds we have Capital employed in the Group of twelve-and-a-half millions, and the strength of the liquid position is demonstrated in that we have net Current Assets of seven millions.

Turning to the export trade, there has been an increasing toughness in the export markets, brought about by more intensive competition as well as import restrictions overseas. We have sought out new territories for our exports and last year supplied goods to no fewer than 112 countries, appreciably more than in the previous year, and again including dollar-earning markets.

The Future

There is no doubt that the cable industry of this country is passing through a period of difficulty. The large-scale expansion of the industry which has taken place since the last war has resulted in excess capacity which, in the present state of world demand, cannot be fully employed. There is a tendency to stimulate a degree of rationalisation in the industry, with the object of securing maximum economies in production administration and selling.

Much ingenuity and enterprise will be required to solve our problems, but the history of the industry is such that I am confident that it will be successful in adapting its structure and organisation to meet its difficulties.

I come now to changes amongst your Board of Directors. I propose to hand over the chairmanship to Sir Alexander Sim. Your Board are confident that he will fill the position of chairman excellently. Your Board has asked me to remain as a director, and this I am happy to do.

The report and accounts were adopted.

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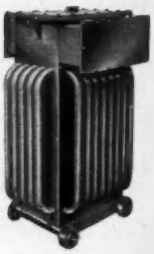

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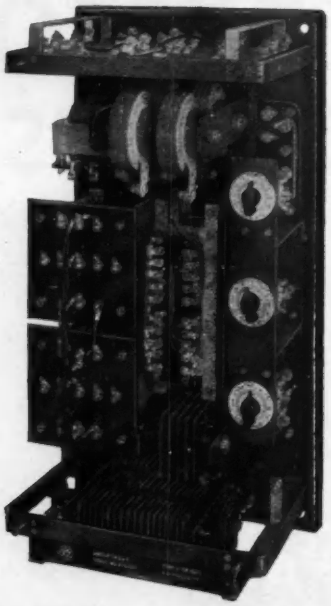

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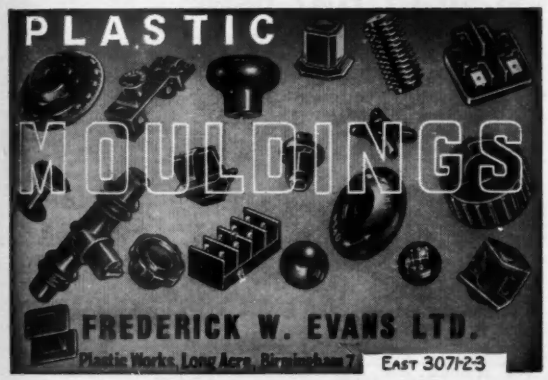

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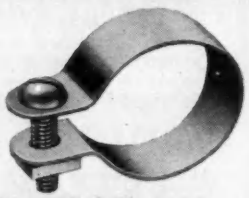

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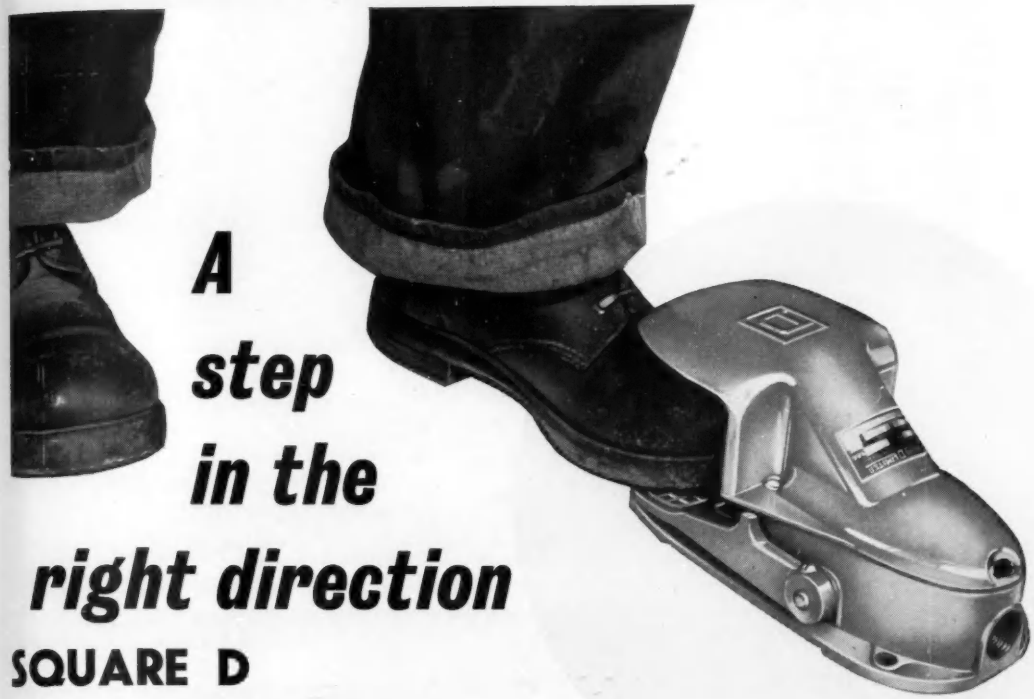

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SQUARE D *multi-feature* FOOT SWITCHES

CLASS 9002 HEAVY DUTY OIL-TIGHT SWITCHES

CLASS 9002 TYPE AW • 600 VOLTS MAX. AC/DC		TYPE											
Description & Special Features		AW-1	AW-2	AW-3	AW-4	AW-5	AW-6	AW-7	AW-8	AW-9	AW-10	AW-11	AW-12
Contact Arrangement	S.P.D.T.	○1○ ○ ○	○1○ ○ ○	○1○ ○ ○	○1○ ○ ○	TWO STAGE see insert below		○1○ ○ ○	○1○ ○ □	TWO STAGE see insert below		250 volts A.C./D.C. maximum ○1○	○1○
	D.P.D.T.			○1○ ○ ○	○1○ ○ ○				○1○ ○ ○				
Mechanical Latch		Two Stage Contact Arrangement						*	*	*	*		
Two-stage		Pedal Position				*	*			*	*		
Two-stage with Mech. Latch in 1st stage		Up		Half Down	Full Down					*			
Two-stage with Mech. Latch in 2nd stage		○1○ ○ ○		○1○ ○ ○	○1○ ○ ○						*		
Maintained Contact Ratchet type		○1○ ○ ○		○1○ ○ ○	○1○ ○ ○							*	*
With Pedal Guard			*		*		*	*	*	*	*		*
Without Pedal Guard		*		*		*						*	

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Switches are available in combinations up to a total of two normally open and two normally closed poles. Double throw construction is particularly useful in providing non-repeat features in press control. Contact operation is snap action and trip point is adjustable with respect to foot pedal position.

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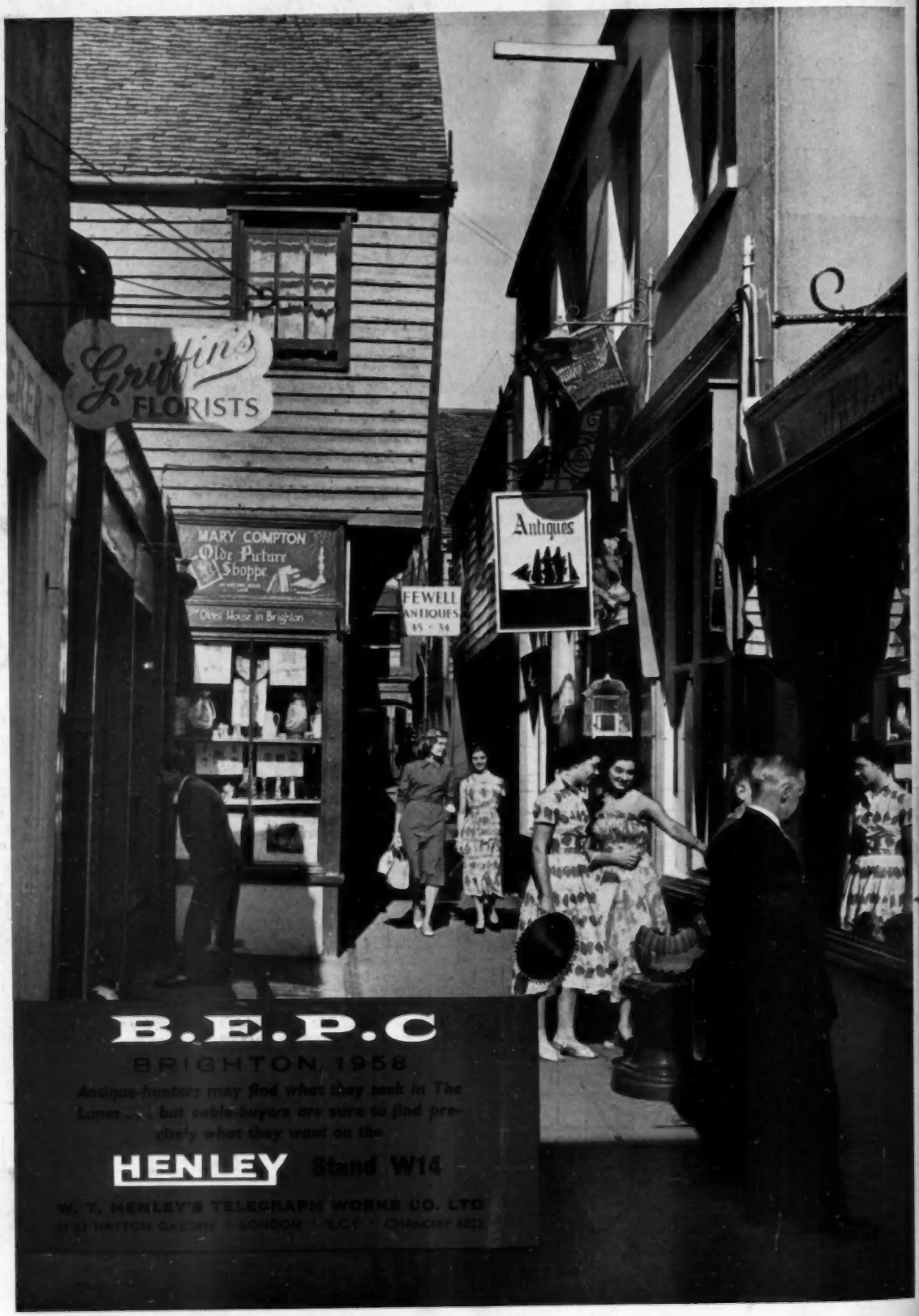
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